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# Aspen Community Types of Utah

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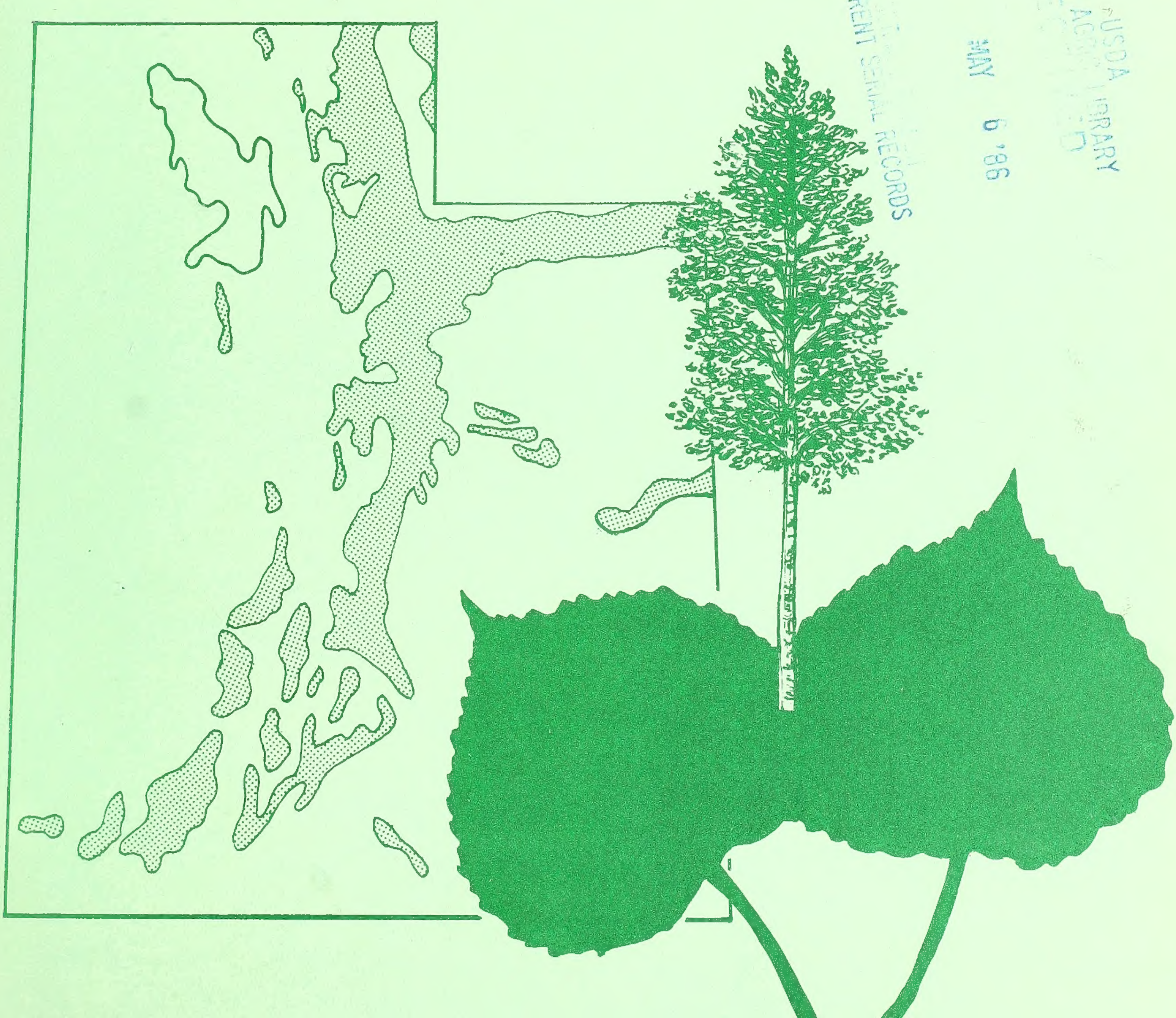

## THE AUTHORS

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## RESEARCH SUMMARY


A vegetation classification for the aspen-dominated forests of Utah is based upon existing community structure and plant species composition. Included are 36 community types that occur within six cover-type categories. A diagnostic key using indicator species facilitates field identification of the community types. Vegetational composition, productivity, and successional status are included. Tables provide detailed comparisons of community types. The classification and descriptions are based upon data from over 1,200 aspen stands scattered across the six National Forests within Utah.


## ACKNOWLEDGMENTS


Assistance in collecting field data was provided by summer technicians Kevin Gardner and Elizabeth Cole. Some stand data related to separate studies on aspen to conifer succession were furnished by Roy Harniss (Intermountain Research Station) and Ronald Mauk (Utah State University). The computer programs used to prepare synthesis and summary tables essential to development of the classification were written by Ronald Mauk.

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## INTRODUCTION

Aspen (*Populus tremuloides* Michx.) forests are a classic example of multiple-use wildlands. Traditionally recognized for their importance as summer range for livestock, prime habitat for many species of wildlife, productive watersheds, and their scenic contribution, aspen forests in the West are rapidly gaining importance as well for their potential to produce wood fiber. In addition, aspen lands contribute greatly to vegetation diversity wherever they occur in the Intermountain and Rocky Mountain States.

Utah contains over 1.6 million acres (648 000 ha) of aspen-dominated forests (Green and Van Hooser 1983). These aspen forests span a broad range of environments and are of varied successional status. Aspen thrive under a variety of elevation, moisture, and soil conditions and are thus associated with widely diverse vegetation types. These range from the cool, moist, high-elevation spruce-fir forests, where aspen frequently plays a dominant successional role, to the relatively dry, low-elevation sagebrush steppes where permanent, isolated aspen groves are a highly valued part of the landscape.

Aspen lands are a prominent part of the vegetation complex on all six of Utah's National Forests, which encompass the high plateaus and mountain ranges of the State (fig. 1). These highlands form essentially a continuous chain through the center of Utah, from Idaho and Wyoming southward to the Arizona border.

Aspen generally occupies an intermediate elevation zone in these highlands, which gets progressively higher as latitude decreases. On the Wasatch-Cache National Forest in northern Utah (fig. 1), for example, aspen forests are commonly found between 5,900 and 9,200 ft (1 800 and 2 800 m) elevation. In southern Utah on the Dixie National Forest, aspen forests most frequently occur between 7,500 and 10,500 ft (2 300 and 3 200 m) elevation. Aspen is usually a seral tree in climax subalpine fir (*Abies lasiocarpa* [Hook.] Nutt.) associations at the higher elevations. In such situations it may dominate the forest community for many decades following severe disturbance, such as fire or clearcutting, but will gradually decline as the conifers become reestablished. At lower elevations aspen can occur either as a temporarily dominant seral species in a variety of climax conifer associations, or it can achieve permanent dominance as the climax forest type. The environmental conditions related to aspen's role as a seral and as a climax species remain ill-defined.

The variety of undergrowth on aspen lands, caused by the range of abiotic environments suitable for aspen growth and aspen's ability to function as a seral-dominant as well as a climax-dominant tree, is compounded by the general use of these lands for grazing. Aspen lands have provided prime summer range for both sheep and cattle in Utah since settlement in the latter half of the 19th century. Some 100 years of grazing at varying intensity (frequently very intense in the early 1900's), and by different classes of livestock, have left their mark in often severe alteration of undergrowth composition and production. Some of these alterations are pronounced; others are subtle and difficult to assess.

The broad environmental and successional diversity encompassed by Utah's aspen lands is reflected inevitably by variations in the forage, wildlife habitat, wood, and water to be derived from these lands. Additionally, equal variability can be expected in the response of these lands to management activities. Such diversity needs to be partitioned into manageable units to facilitate intensive resource management. This is usually done by classification. Since about 1970, considerable effort has been devoted to developing habitat type classifications for wildlands in the Western United States. Habitat types, as conceptualized and used by Daubenmire and Daubenmire (1968), are aggregations of land units capable of supporting similar climax plant communities and are based upon species composition of climax communities. These classifications are useful to resource managers for partitioning lands and as a basis for structuring management recommendations. Habitat type classifications have recently been developed for the coniferous forests of northern Utah (Mauk and Henderson 1984) and for southern Utah (Youngblood and Mauk 1985). In these classifications, aspen was primarily considered to be either a species seral to a conifer climax or else persistently seral with unknown climax potential. Consequently, the aspen type was described only superficially.

The widespread dominance of aspen on extensive portions of Utah's wildlands increased the need for a classification that would partition the variability of this important forest type. Ideally, the classification should incorporate information related to the successional as well as to the climax status of aspen. The habitat-type approach did not appear feasible for such a classification because of its reliance on potential rather than existing vegetation, and the uncertain successional status of aspen in different situations. Determining precisely the influence of widespread disturbance, whether natural or human-caused, results at best in tenuous projection of potential climax composition under the range of environments suited to aspen dominance. A community-type

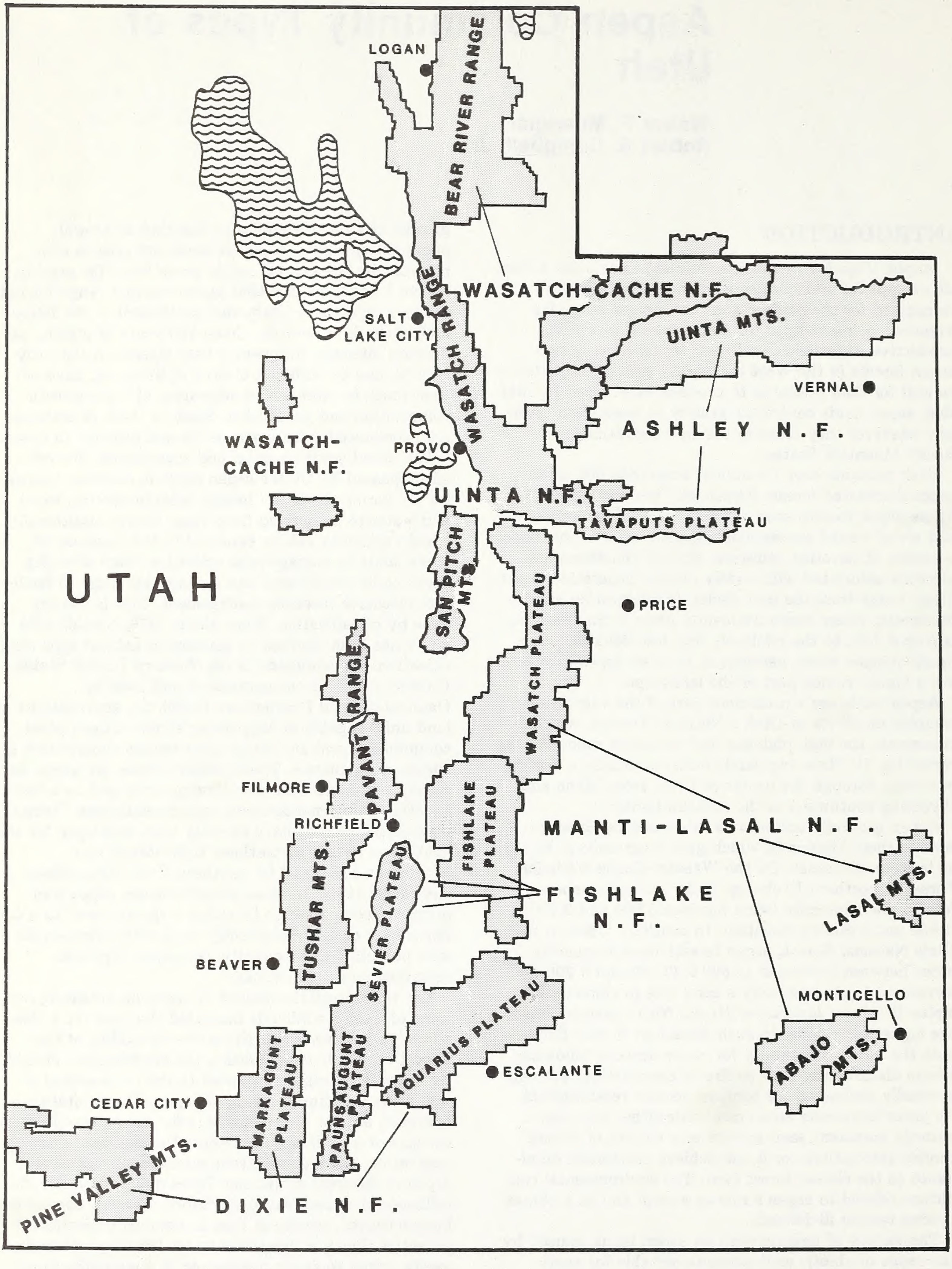


Figure 1.—National Forest lands in Utah covered by this classification and the location of the major mountain divisions discussed in the text.

approach is appropriate, however, because it avoids the presumption of climax.

Community types are aggregations of similar plant communities based upon existing floristics regardless of successional status. As with habitat types, community types view the plant community as an environmental integrator, and thus reflect major environmental differences. Community types may either represent climax plant associations or represent successional stages toward climax plant associations. In either event, resource managers in the field must contend with this existing vegetation. Once community types are defined, effort can be directed toward establishing successional relationships and linking seral community types to known habitat types where appropriate. Meanwhile, the community types can be used as a basis for mapping and resource management planning.

Community type classifications for aspen lands have been developed within the Forest Service's Intermountain Region for the Bridger-Teton National Forest in western Wyoming (Youngblood and Mueggler 1981) and for the Targhee and Caribou National Forests in southeastern Idaho (Mueggler and Campbell 1982). This classification extends the earlier efforts southward to describe aspen lands on and near the six National Forests in Utah: Wasatch-Cache, Uinta, Ashley, Manti-LaSal, Fishlake, and Dixie. During the process of structuring these aspen-land classifications for the Intermountain Region, concepts have continued to evolve that we hope will enhance their use. Our objective was to produce aspen-land classifications, and supporting information, that would serve to facilitate multiple-use management in the Intermountain Region.

# METHODS

The community-type approach to classification development necessitates extensive sampling to adequately encompass and replicate the variation in composition of existing vegetation resulting from both abiotic and biotic environmental influences. However, acquisition of quantitative data on stand structure, undergrowth productivity, and certain other desired factors can be laborious. Because we did not have the resources to measure all stands at the desired intensity and still acquire an adequate number of stands upon which to base a useful classification, we used a dual sampling approach. One person sampled reconnaissance plots by traveling independently from a two-person crew responsible for sampling the separate and more time-consuming intensive plots. On the reconnaissance plots, species composition was estimated, and some environmental factors were characterized. The intensive plots yielded data on stand structure, age, productivity, and environment as well as species composition.

## Field Methods

Aspen stands for sampling were found primarily by traveling forest roads throughout Utah looking for reasonably accessible candidates. We used only two selection criteria: at least 50 percent of the tree canopy cover had to consist of aspen, and the stand had to be large enough to contain a single macroplot within an apparently uniform environment. Our intent was to sample the full environmental range where aspen expressed dominance. Neither successional status nor grazing intensity were considerations in stand selection. Thus, although the actual selection of stands was subjective, this selection avoided preconceived bias that could influence the resulting classification.

Upon selection for intensive sampling, a single 1/13-acre (314-$m^2$) circular macroplot was established in a relatively uniform and representative portion of the stand. Ecotones at stand margins and atypical openings were avoided, as were clonal ecotones where a stand was composed of more than one discernible aspen clone. Tree data by species, collected from the entire macroplot, consisted of: an ocular estimate of overhead canopy cover; reproduction as number of stems with heights less than 4 inches (1 dc), 4 to 12 inches (1 to 3 dc), and 12 to 55 inches (3 to 14 dc); number of stems by 2-inch (5-cm) diameter at breast height (d.b.h.) size classes; and age, height, and d.b.h. of individual trees selected to represent the dominants and other well-defined size strata. We determined species composition of the undergrowth shrubs and herbs by estimating canopy cover by species, based upon careful overall scrutiny of the entire macroplot. In addition, we estimated canopy cover for the vegetational classes of shrubs, graminoids, forbs, and annuals. Undergrowth biomass was determined by a combination of estimating and clipping current year's growth of shrubs below 5 ft (1.5 m) high, and herbs on three sets of microplots randomly distributed on the 1/13-acre (314-$m^2$) macroplot. Each set of microplots consisted of a cluster of five circular 5.4-$ft^2$ (0.5-$m^2$) plots on which the current growth on four was estimated as a percentage of the fifth, which was then clipped. The clipped material was saved and later dried for 48 h at 158 °F (70 °C). The percentage estimates from the four plots in a set were then converted to dry weight. An estimated correction was applied at the time of sampling to adjust the weights for sampling either before or after the time of peak standing crop, as well as to compensate for obvious livestock use. These adjustments were highly subjective but deemed necessary to compensate for obvious production distortions caused by time of sampling and use. Estimated undergrowth production, therefore, was based on 15 microplots per stand. All production values given are dry weights. We determined the following environmental factors for each intensively sampled stand: elevation, aspect, percent slope, landform, soil parent material, depth of melanized layer, and estimates of rooting depth, soil rockiness, and soil texture. We also recorded location, evidence of succession, livestock use, and other interpretative information.

The considerably more rapid reconnaissance technique consisted of choosing an approximately 1/10-acre (1/25-ha) uniform portion of the stand to be sampled and estimating selected vegetation factors. Canopy cover of each tree species was estimated separately for that portion over 4.6 ft (1.4 m) high and the reproduction under this height. Percentage canopy cover for each shrub and herbaceous species, as well as for vegetation classes, was estimated after carefully scrutinizing the area. We

recorded the environmental factors of elevation, aspect, landform, and soil parent material, and also location and interpretative information related to succession and animal use.

Data from 1,233 aspen stands were accumulated in this manner to form the basis for describing the aspen communities in Utah. We sampled 421 of these stands intensively; the remaining 812 were sampled by the reconnaissance technique.

## Data Analysis

Prior to placing the field data on computer file for analysis, we confirmed the identification of voucher plant specimens and identified the collections of questionable species. The coding and key-punching of all vegetation and environmental data were checked for errors.

Development of the classification categories relied principally upon use of synthesis or association tables (Mueller-Dombois and Ellenberg 1974). Before the process of stand alignment and reiteration began, every tenth stand was temporarily deleted from the file to serve as an unbiased validation of the classification that would be developed, and validation of the field key constructed to assist in identification of the community types. These validation stands were subsequently reintroduced into the data file for compilation of all tables summarizing the community type data. The synthesis table method permitted subjective recognition of similarities in vegetation structure and in species fidelity, constancy, and coverage. We considered certain species to be indicative of natural succession, environment, grazing degradation, and management concerns; numerous reiterations of stand alignments permitted sequencing according to visual similarities of these important species.

We subsequently grouped the stands into community types according to the constancy and abundance of the selected indicator species. Similarity of vegetational structure was a prime consideration in forming the groups. The presence or absence of substantial amounts of conifers in the overstory, or potentially so as judged by conifer regeneration, was the first separation criterion. These were categorized as aspen-conifer cover types (table 1). The presence of substantial amounts of conifers was considered highly relevant because of successional implications. In the normal course of succession, all such mixed cover types will probably succeed to coniferous forest climax communities. The presence of a tall shrub layer and of a low shrub layer were the second and third criteria considered in grouping stands. These shrub layers not only tend to reflect environmental differences but are also highly relevant to management. We selected the indicator species in the herbaceous layer as the most sensitive indicators of abiotic environmental extremes and of severe vegetational alterations caused by prolonged excessive grazing. Thus, species' prevalence within the tree, shrub, and herb life-form classes were used to delineate and characterize the aspen community types.

After we grouped the stands into what appeared to be sensible community types, we prepared a dichotomous key based upon characterizing species and checked against all stands used to develop the classification. This key was developed to facilitate field use of the classification. The last step was to use the key to classify the validation stands into community types and then to compare the species composition of these groups with that of the original groups used to develop the classification. Less than 5 percent of the original stands used to form the classification could not readily be placed into identifiable community types. Similarly, about 3 percent of the validation stands did not fit the classification. These undetermined stands (20 intensively sampled and 34 reconnaissance) are likely either unusual isolated communities, or else represent ill-defined community types reflecting restricted environmental situations.

Whether a community is seral or stable can appreciably affect management decisions. Therefore, the ability to judge the successional status of the aspen community types is important. Community stability is indicated when existing individuals are replaced by their own progeny, without disturbance; thus, the community is self-perpetuating. In seral communities, current populations of some species tend to be replaced by other species, resulting in gradual changes in composition. Although accurate determination of community stability may require intensive ecological study, preliminary determinations are possible by comparing vegetational composition with that of communities of known stability, evaluating the age structure of the woody species and the proportions of shade-tolerant species, and examining the relative abundance of species known to increase with such disturbance as excessive livestock grazing. We have attempted to clarify the successional status of the aspen community types in Utah by linking them to either Mauk and Henderson's (1984) coniferous forest habitat type classification for northern Utah, or to Youngblood and Mauk's (1985) classification for central and southern Utah, and to other community types in our aspen classification. At best, the linkages are only suggestive and will require intensive separate study for confirmation of the successional relationships. Our judgments of the successional status of each community type are shown in table 2.

**Table 1.**—Aspen community types (c.t.) by cover type categories in Utah

| Cover type and community type | Abbreviation |
|---|---|
| *Populus tremuloides* cover type | |
| (Tall shrub undergrowth type) | |
| *P. tremuloides/Acer grandidentatum/Pteridium aquilinum* c.t. | POTR/ACGR/PTAQ |
| *P. tremuloides/Prunus virginiana/Senecio serra* c.t. | POTR/PRVI/SESE |
| *P. tremuloides/Prunus virginiana/Carex geyeri* c.t. | POTR/PRVI/CAGE |
| (Low shrub undergrowth type) | |
| *P. tremuloides/Sambucus racemosa* c.t. | POTR/SARA |
| *P. tremuloides/Symphoricarpos oreophilus/Senecio serra* c.t. | POTR/SYOR/SESE |
| *P. tremuloides/Symphoricarpos oreophilus/Carex geyeri* c.t. | POTR/SYOR/CAGE |
| *P. tremuloides/Symphoricarpos oreophilus/Festuca thurberi* c.t. | POTR/SYOR/FETH |
| *P. tremuloides/Juniperus communis/Carex geyeri* c.t. | POTR/JUCO/CAGE |
| *P. tremuloides/Juniperus communis/Sitanion hystrix* c.t. | POTR/JUCO/SIHY |
| *P. tremuloides/Symphoricarpos oreophilus/Bromus carinatus* c.t. | POTR/SYOR/BRCA |
| *P. tremuloides/Symphoricarpos oreophilus/Poa pratensis* c.t. | POTR/SYOR/POPR |
| *P. tremuloides/Juniperus communis/Astragalus miser* c.t. | POTR/JUCO/ASMI |
| (Herb undergrowth type) | |
| *P. tremuloides/Veratrum californicum* c.t. | POTR/VECA |
| *P. tremuloides/Heracleum lanatum* c.t. | POTR/HELA |
| *P. tremuloides/Pteridium aquilinum* c.t. | POTR/PTAQ |
| *P. tremuloides/Senecio serra* c.t. | POTR/SESE |
| *P. tremuloides/Carex geyeri* c.t. | POTR/CAGE |
| *P. tremuloides/Festuca thurberi* c.t. | POTR/FETH |
| *P. tremuloides/Sitanion hystrix* c.t. | POTR/SIHY |
| *P. tremuloides/Bromus carinatus* c.t. | POTR/BRCA |
| *P. tremuloides/Poa pratensis* c.t. | POTR/POPR |
| *Populus tremuloides-Abies lasiocarpa* cover type | |
| *P. tremuloides-A. lasiocarpa/Vaccinium caespitosum* c.t. | POTR-ABLA/VACA |
| *P. tremuloides-A. lasiocarpa/Amelanchier alnifolia* c.t. | POTR-ABLA/AMAL |
| *P. tremuloides-A. lasiocarpa/Symphoricarpos oreophilus/ Senecio serra* c.t. | POTR-ABLA/SYOR/SESE |
| *P. tremuloides-A. lasiocarpa/Symphoricarpos oreophilus/ Carex geyeri* c.t. | POTR-ABLA/SYOR/CAGE |
| *P. tremuloides-A. lasiocarpa/Juniperus communis* c.t. | POTR-ABLA/JUCO |
| *P. tremuloides-A. lasiocarpa/Senecio serra* c.t. | POTR-ABLA/SESE |
| *P. tremulòides-A. lasiocarpa/Carex geyeri* c.t. | POTR-ABLA/CAGE |
| *Populus tremuloides-Abies concolor* cover type | |
| *P. tremuloides-A. concolor/Symphoricarpos oreophilus* c.t. | POTR-ABCO/SYOR |
| *P. tremuloides-A. concolor/Juniperus communis* c.t. | POTR-ABCO/JUCO |
| *Populus tremuloides-Pseudotsuga menziesii* cover type | |
| *P. tremuloides-P. menziesii/Amelanchier alnifolia* c.t. | POTR-PSME/AMAL |
| *P. tremuloides-P. menziesii/Juniperus communis* c.t. | POTR-PSME/JUCO |
| *Populus tremuloides-Pinus ponderosa* cover type | |
| *P. tremuloides-P. ponderosa/Quercus gambelii* c.t. | POTR-PIPO/QUGA |
| *P. tremuloides-P. ponderosa/Juniperus communis* c.t. | POTR-PIPO/JUCO |
| *Populus tremuloides-Pinus contorta* cover type | |
| *P. tremuloides-P. contorta/Vaccinium scoparium* c.t. | POTR-PICO/VASC |
| *P. tremuloides-P. contorta/Juniperus communis* c.t. | POTR-PICO/JUCO |

Table 2.—Apparent successional relationships between aspen community types (c.t.) in Utah and climax community types (c.c.t.), or previously described habitat types (h.t.). Type names enclosed in parentheses are less likely related than those not enclosed

| Aspen community type | | Climax community types or habitat types |
|---|---|---|
| POTR/ACGR/PTAQ | ----→ | POTR/ACGR/PTAQ c.c.t.<br>(POTR/PRVI/SESE c.c.t.) |
| POTR/PRVI/SESE | ----→ | POTR/PRVI/SESE c.c.t.<br>(ABLA/OSCH h.t.)[1] |
| POTR/PRVI/CAGE | ----→ | POTR/PRVI/CAGE c.c.t.<br>(ABLA/BERE h.t.)[1]<br>(ABLA/CAGE h.t.)[2] |
| POTR/SARA | ----→ | POTR/SARA c.c.t. |
| POTR/SYOR/SESE | ----→ | POTR/SYOR/SESE c.c.t.<br>(ABLA/OSCH h.t.)[1]<br>(ABLA/ACCO h.t.)[2] |
| POTR/SYOR/CAGE | ----→ | POTR/SYOR/CAGE c.c.t.<br>(PSME/SYOR h.t.)[1,2]<br>(PSME/BERE h.t.)[1,2]<br>(ABLA/BERE h.t.)[1,2] |
| POTR/SYOR/FETH | ----→ | POTR/SYOR/FETH c.c.t. |
| POTR/JUCO/CAGE | ----→ | POTR/JUCO/CAGE c.c.t.<br>(ABLA/JUCO h.t.)[1,2]<br>(ABLA/BERE h.t.)[1,2]<br>(PSME/BERE h.t.)[1,2] |
| POTR/JUCO/SIHY | ----→ | POTR/JUCO/SIHY c.c.t.<br>(PIPO/FEID h.t.)[1]<br>(PSME/BERE h.t.)[2] |
| POTR/SYOR/BRCA | ----→ | POTR/SYOR/SESE c.c.t.<br>(ABLA/OSCH h.t.)[1]<br>(ABLA/ACCO h.t.)[2] |
| POTR/SYOR/POPR | ----→ | POTR/SYOR/CAGE c.c.t.<br>POTR/SYOR/SESE c.c.t. |
| POTR/JUCO/ASMI | ----→ | POTR/JUCO/CAGE c.c.t.<br>(ABLA/JUCO h.t.)[1]<br>(ABLA/BERE h.t.)[1] |
| POTR/VECA | ----→ | POTR/VECA c.c.t. |
| POTR/HELA | ----→ | POTR/HELA c.c.t. |
| POTR/PTAQ | ----→ | POTR/PTAQ c.c.t.<br>(POTR/SESE c.c.t.) |
| POTR/SESE | ----→ | POTR/SESE c.c.t.<br>(ABLA/OSCH h.t.)[1] |
| POTR/CAGE | ----→ | POTR/CAGE c.c.t.<br>(ABLA/BERE h.t.)[1,2] |

Table 2. (Con.)

| Aspen community type | | Climax community types or habitat types |
|---|---|---|
| POTR/FETH | ----→ | POTR/FETH c.c.t.<br>(POTR/SYOR/FETH c.c.t.) |
| POTR/SIHY | ----→ | POTR/SIHY c.c.t.<br>(PIPO/FEID h.t.)[1]<br>(PIPO/SYOR h.t.)[2] |
| POTR/BRCA | ----→ | POTR/SESE c.c.t.<br>(POTR/SYOR/SESE c.c.t.)<br>(ABLA/OSCH h.t.)[1] |
| POTR/POPR | ----→ | POTR/CAGE c.c.t.<br>POTR/SYOR/CAGE c.c.t.<br>(ABLA/BERE h.t.)[1,2] |
| POTR-ABLA/VACA | ----→ | ABLA/VACA h.t.[1]<br>(ABLA/VASC h.t.)[1] |
| POTR-ABLA/AMAL | ----→ | ABLA/OSCH h.t.[1]<br>ABLA/ACGL h.t.[1] |
| POTR-ABLA/SYOR/SESE | ----→ | ABLA/OSCH h.t.[1] |
| POTR-ABLA/SYOR/CAGE | ----→ | ABLA/CAGE h.t.[2]<br>ABLA/BERE h.t.[1,2] |
| POTR-ABLA/JUCO | ----→ | ABLA/JUCO h.t.[1,2]<br>ABLA/BERE h.t.[1,2] |
| POTR-ABLA/SESE | ----→ | ABLA/OSCH h.t.[1]<br>(ABLA/ACCO h.t.)[2] |
| POTR-ABLA/CAGE | ----→ | ABLA/CARO h.t.[2] |
| POTR-ABCO/SYOR | ----→ | ABCO/BERE h.t.[1,2]<br>(ABCO/OSCH h.t.)[1] |
| POTR-ABCO/JUCO | ----→ | ABCO/JUCO h.t.[2]<br>(PIPU/JUCO h.t.)[2] |
| POTR-PSME/AMAL | ----→ | PSME/OSCH h.t.[1]<br>PSME/ACGL h.t.[1]<br>PSME/BERE h.t.[1] |
| POTR-PSME/JUCO | ----→ | PSME/BERE h.t.[1,2]<br>PSME/SYOR h.t.[1,2] |
| POTR-PIPO/QUGA | ----→ | PIPO/CAGE h.t.[1]<br>PIPO/QUGA h.t.[2]<br>(PIPO/SYOR h.t.)[2] |
| POTR-PIPO/JUCO | ----→ | PIPO/FEID h.t.[1]<br>PIPO/SYOR h.t.[2] |
| POTR-PICO/VASC | ----→ | PICO/VASC h.t.[1]<br>ABLA/VASC h.t.[1] |
| POTR-PICO/JUCO | ----→ | PICO/BERE h.t.[1]<br>ABLA/BERE h.t.[1]<br>ABLA/JUCO h.t.[1] |

[1]Described by Mauk and Henderson (1984).
[2]Described by Youngblood and Mauk (1985).

An objective index to probable successional relationship between the community types in the aspen-conifer cover type series and recognized conifer habitat types (Mauk and Henderson 1984; Youngblood and Mauk 1985) was arrived at by computing a similarity index comparing species' presence. Our premise was that species with high constancy in one type are more likely to occur with higher constancy in a related than in a nonrelated type. A constancy of 50 percent in either one of the compared types was required for a species to be included in the comparison. Sorensen's community coefficient (Mueller-Dombois and Ellenberg 1974) was then computed as an objective similarity index comparing the similarity of species constancy values for the two types.

Data on 460 plant species representing 210 genera were collected and evaluated. Of these, we used 168 of the more important species to prepare the tables in appendix A, which summarize the constancy of occurrence of species within community types and their average canopy cover. These tables permit a ready comparison of species composition in the different aspen community types.

The basal area and site index of aspen are summarized by community type in appendix B. We computed 80-year site index for each of the intensively sampled stands using Jones' (1967) site index curves for aspen. Appendix C contains total tree basal area and the percent consisting of conifers.

Undergrowth production, composition by vegetational classes, and forage suitability are summarized in appendixes D and E. We derived an approximation of suitability as livestock forage from species forage suitability ratings developed for the Intermountain Region by USDA Forest Service (1981), and then adjusted this to a percentage composition based on canopy cover estimates. We consider the proportion of canopy cover composed of species in each of three suitability classes (desirable, intermediate, least) to be an index to the value of the undergrowth as livestock forage. This was computed for each community type by summing the constancy times the cover data (appendix A) for each species within each suitability class, and dividing by the summation of constancy times cover for all classes to give a relative percentage within each class.

Appendix F shows the proportion of the stands sampled on each of Utah's six National Forests that were in each community type. A field form (appendix G) is provided to facilitate acquisition of the data needed to classify Utah aspen lands.

## Other Considerations

An understanding of the general concepts guiding development of this classification may add perspective to its potential use. We sought to develop a natural classification, yet one that would incorporate technical considerations, particularly with respect to vegetational structure and type nomenclature. Perceived usefulness was an overriding consideration. Vegetation structure is considered important because of its effect on undergrowth composition and production, its reflection of environment, and its possible relevancy to management. The nomenclature of the community types is arranged to reflect up to three distinct structural layers that commonly form aspen communities: the overstory tree layer, the shrub layer (when present), and the herbaceous layer. The type name consists of the name of the indicator species within each layer separated by a slash.

The classification is based upon existing rather than potential vegetation. Thus, the units should be readily recognizable by forest and range technicians. However, because it is a classification of existing vegetation, the units reflect the effects of both abiotic and biotic influences. This problem is abated somewhat by our attempt to indicate the probable successional status of each type and its relationship to recognized habitat types. In arriving at type separations, our approach was to stress the "boundary" or difference between types rather than the modal conditions of each type. Usually we found it best to separate the wettest types first and proceed to those occupying drier sites. Our concept was that species with high moisture requirements have more difficulty growing under drier conditions than species with less stringent moisture requirements have in growing under wetter conditions.

A word of explanation regarding our concept of plant community organization. Seldom, if ever, do plant communities fall into clearcut taxonomic units, because no two plant communities are identical; species composition differs from place to place because of environmental and successional gradients and because of chance. Even where environmental stability and lack of physical disturbance have permitted the development of climax communities, subtle differences in the microenvironment, and the factor of chance, contribute to certain differences in the kinds and amounts of species making up each community. Such differences in species composition are even more pronounced in seral vegetation, which reflects, in addition, the variable effects of past disturbance. Vegetation classification, therefore, becomes a matter of arbitrarily deciding upon the amount of variability in composition tolerable in defining the taxonomic units. The amount of variability acceptable should be determined by the need for and projected use of the resulting classification.

No single flora satisfactorily described all plant species encountered during the course of our study. We relied heavily on Hitchcock and Cronquist (1973) for northern Utah, and Harrington (1954) for general Utah coverage. Welsh and Moore (1973), Martin and Hutchins (1980), and Arnow and others (1977) were used to help clarify identifications when the primary floras appeared inadequate.

Certain species nomenclature usage should be noted. The difficulty of separating some species without flowers or mature fruits was resolved by combining the species in question. Thus, *Osmorhiza chilensis* and *Osmorhiza depauperata* are treated as *O. chilensis,* and *Rosa woodsii* and *Rosa nutkana* are under *R. woodsii.* Other species, though separately identified in the field, were combined in the community-type summaries for convenience because of their similarity. These are: *Sambucus racemosa* and *Sambucus cerulea* as *S. racemosa; Fragaria vesca* and *Fragaria virginiana* as

*F. vesca; Polemonium foliosissimum* and *Polemonium occidentale* as *P. foliosissimum;* and *Delphinium occidentale* and *Delphinium barbeyi* as *D. occidentale.* Nomenclature ambiguities forced a somewhat arbitrary selection of names for some species. Thus the *Agropyron trachycaulum-Agropyron subsecundum-Agropyron caninum* complex is treated as *A. trachycaulum; Bromus marginatus* and *Bromus polyanthus* are included with *Bromus carinatus;* and *Stipa columbiana* and *Stipa nelsonii* are lumped with *Stipa occidentalis.* The traditional name of *Koeleria cristata* is used to include *Koeleria nitida.* Considerable confusion revolves around the separation of *Geranium viscosissimum* and *Geranium fremontii.* This confusion is reflected by different floras in adjacent States that seldom treat both species and that may indicate that *G. fremontii* is synonymous with *G. viscosissimum.* We have arbitrarily chosen to call this uncertain, pink-flowered complex *G. viscosissimum.*

## THE CLASSIFICATION: VEGETATION KEY

This classification partitions those forests in Utah where aspen comprises at least 50 percent of the tree canopy into six cover types based upon the dominant and codominant trees. These cover types are then separated into 36 community types based upon prominent indicator species in the undergrowth. Table 3 is the vegetation key for the classification.

Although aspen generally has relatively broad environmental tolerances, it typically is less shade tolerant and shorter lived than most conifers. Thus, aspen stands that contain a substantial element of conifers are considered to be at a seral stage leading toward a conifer climax. They are categorized as aspen-conifer cover types. The aspen-conifer cover types are separated by minimal amounts of conifer occurrence, giving sequential consideration first to those conifers that require the less stressful moist sites, and proceeding eventually to those that are able to occupy the driest sites. *Pinus contorta,* an exception, is taken out last because it is usually considered seral to other conifers. At least 5 percent canopy cover of *Abies lasiocarpa,* alone or combined with *Picea engelmannii,* qualifies a stand for the *Populus tremuloides-Abies lasiocarpa* cover type. At least 10 percent canopy cover is required for *Abies concolor, Pseudotsuga menziesii,* and *Pinus contorta;* only 5 percent is required for *Pinus ponderosa.* These minimal cover requirements are subjectively judged to be more than accidental and to approximate the level required for the conifer species to validly indicate site differences, as well as being indicative of successional trends.

The *Populus tremuloides* cover type is further subdivided into three undergrowth types based upon vegetational structure. Those communities possessing a distinct tall shrub component are placed in the tall shrub undergrowth type. Those without a tall shrub layer but that possess a distinct layer of low shrubs are placed in the low shrub undergrowth type. Community types that lack a well-defined layer of shrubs are placed within the herb undergrowth type.

The largest number of community types (21) occurred within the *Populus tremuloides* cover type. The *P. tremuloides-A. lasiocarpa* cover type contained seven community types; the remaining four cover types contained only two community types each. Community types were based on as few as two stands in one case where composition and environment were unique (and the type had been reported elsewhere), to as many as 152 stands in the most common type. Over 40 percent of the stands classified fell into only four community types: *P. tremuloides/Symphoricarpos oreophilus/Senecio serra* c.t.; *P. tremuloides/S. serra* c.t.; *P. tremuloides/Prunus virginiana/S. serra* c.t.; and *P. tremuloides-A. lasiocarpa/S. serra* c.t. Over half of the community types were infrequent but are considered valid because of their repeated occurrence in the large number of stands that served as our data base. A listing of all community types is given in table 1. Less than 5 percent of all stands sampled could not be matched with any of the 36 community types listed.

**Table 3.**—Vegetation key to aspen community types (c.t.) in Utah, where *Populus tremuloides* constitutes at least 50 percent of the tree canopy

Note: The "tall forb group" referred to in this key consists of the following species:

| | |
|---|---|
| *Agastache urticifolia* | *Polemonium foliosissimum* |
| *Aster engelmannii* | *Rudbeckia occidentalis* |
| *Delphinium occidentale* | *Scrophularia lanceolata* |
| *Mertensia arizonica* | *Senecio serra* |
| *Osmorhiza occidentalis* | *Valeriana occidentalis* |

Note: Adjective descriptors:
trace = less than 1% cover
scarce, present, readily apparent = 1% to 4% cover
conspicuous = 5% or greater cover
prominent = 10% or greater cover

## Key to cover types:

I. *Abies lasiocarpa* and/or *Picea engelmannii* at least 5% canopy cover ........ *Populus tremuloides-Abies lasiocarpa* (Go to B)
I. *A. lasiocarpa* and/or *P. engelmannii* less than 5% cover ........ II
II. *Abies concolor* and/or *Picea pungens* at least 10% canopy cover ........ *Populus tremuloides-Abies concolor* (Go to C)
II. *A. concolor* and/or *P. pungens* less than 10% cover ........ III
III. *Pseudotsuga menziesii* at least 10% canopy cover ........ *Populus tremuloides-Pseudotsuga menziesii* (Go to D)
III. *P. menziesii* less than 10% cover ........ IV
IV. *Pinus ponderosa* at least 5% canopy cover ........ *Populus tremuloides-Pinus ponderosa* (Go to E)
IV. *P. ponderosa* less than 5% cover ........ V
V. *Pinus contorta* at least 10% canopy cover ........ *Populus tremuloides-Pinus contorta* (Go to F)
V. *P. contorta* less than 10% cover ........ VI
VI. Some other coniferous trees at least 10% canopy cover ........ Unclassified cover type
VI. Not as above ........ *Populus tremuloides* (Go to A)

## Key to community types:

A. (*Populus tremuloides* cover type)
1. *Prunus virginiana, Amelanchier alnifolia,* or *Acer grandidentatum* (alone or in combination) prominent, generally exceeding 10% canopy cover ........ Tall shrub group (Go to AA)
1. Above-named shrubs totaling less than 10% cover ........ 2
2. *Symphoricarpos oreophilus* prominent with at least 10% canopy cover, or *Juniperus communis* and/or *Artemisia tridentata* conspicuous with at least 5% combined cover, or *Sambucus racemosa* and/or *Sambucus cerulea* with at least 5% cover ........ Low shrub group (Go to AB)
2. Not as above ........ Herb group (Go to AC)

AA. (Tall shrub undergrowth type)
1. *Pteridium aquilinum* conspicuous with at least 5% cover: usually dominates herbaceous layer ........ *Populus tremuloides/Acer grandidentatum/Pteridium aquilinum* c.t. (p. 13)
1. *P. aquilinum* absent, or present in only trace amounts ........ 2
2. One or more members of the tall forb group readily apparent, or *Bromus carinatus* and/or *Elymus glaucus*, alone or in combination usually forming a conspicuous part of herbaceous layer ........ *Populus tremuloides/Prunus virginiana/Senecio serra* c.t. (p. 14)
2. Neither tall forbs nor *B. carinatus* or *E. glaucus* conspicuous ........ 3
3. *Carex geyeri, Carex rossii,* and/or *Stipa occidentalis* conspicuous ........ *Populus tremuloides/Prunus virginiana/Carex geyeri* c.t. (p. 15)
3. Not as above ........ Unclassified type

(con.)

**Table 3.** (Con.)

AB. (Low shrub undergrowth type)

| | |
|---|---|
| 1. *Sambucus racemosa* and/or *Sambucus cerulea* conspicuous with at least 5% canopy cover | *Populus tremuloides/Sambucus racemosa* c.t. (p. 15) |
| 1. *S. racemosa* and *S. cerulea* usually absent; if present, then less than 5% cover | 2 |
| 2. *Juniperus communis* generally exceeding 5% canopy cover | 3 |
| 2. *J. communis* absent or scarce, less than 5% cover | 8 |
| 3. *Festuca thurberi* conspicuous with at least 5% cover; *Symphoricarpos oreophilus* usually present | *Populus tremuloides/Symphoricarpos oreophilus/Festuca thurberi* c.t. (p. 18) |
| 3. *F. thurberi* usually absent; if present, less than 5% canopy cover | 4 |
| 4. *Carex geyeri, Carex rossii,* or *Stipa occidentalis* (alone or in combination) conspicuous, usually with at least 5% canopy cover | *Populus tremuloides/Juniperus communis/Carex geyeri* c.t. (p. 18) |
| 4. Not as above | 5 |
| 5. *Sitanion hystrix, Stipa comata,* and *Stipa lettermanii* (alone or in combination) conspicuous, usually at least 5% total canopy cover | *Populus tremuloides/Juniperus communis/Sitanion hystrix* c.t. (p. 20) |
| 5. Not as above | 6 |
| 6. *Astragalus miser* prominent with at least 10% canopy cover | *Populus tremuloides/Juniperus communis/Astragalus miser* c.t. (p. 21) |
| 6. *A. miser* absent, or forming only an incidental part of the herbaceous layer | 7 |
| 7. *Poa pratensis* and *Symphoricarpos oreophilus* prominent, each with at least 10% cover | *Populus tremuloides/Symphoricarpos oreophilus/Poa pratensis* c.t. (p. 21) |
| 7. Not as above | Unclassified type |
| 8. *Symphoricarpos oreophilus* prominent, at least 10% canopy cover | 13 |
| 8. *S. oreophilus* absent or scarce, less than 10% cover | 9 |
| 9. *Artemisia tridentata* present with at least 5% cover | 10 |
| 9. *A. tridentata* absent or scarce | Go to AC |
| 10. *Carex geyeri, Carex rossii,* and/or *Stipa occidentalis* (alone or in combination) conspicious with at least 5% canopy cover | *Populus tremuloides/Juniperus communis/Carex geyeri* c.t. (p. 18) |
| 10. Not as above | 11 |
| 11. *Sitanion hystrix, Stipa comata,* and/or *Stipa lettermanii* (alone or in combination) conspicuous usually with at least 5% canopy cover | *Populus tremuloides/Juniperus communis/Sitanion hystrix* c.t. (p. 20) |
| 11. Above-named grasses absent or present only in trace amounts | 12 |
| 12. *Astragalus miser* abundant, usually with at least 10% cover | *Populus tremuloides/Juniperus communis/Astragalus miser* c.t. (p. 21) |
| 12. *A. miser* absent, or comprising only an incidental part of the herbaceous layer | Unclassified type |
| 13. *Festuca thurberi* conspicuous with at least 5% canopy cover | *Populus tremuloides/Symphoricarpos oreophilus/Festuca thurberi* c.t. (p. 18) |
| 13. *F. thurberi* generally absent; if present, less than 5% canopy cover | 14 |
| 14. One or more members of the tall forb group readily apparent, alone or in combination usually forming a conspicuous part of the herbaceous layer | *Populus tremuloides/Symphoricarpos oreophilus/Senecio serra* c.t. (p. 16) |
| 14. Members of the tall forb group absent or in total occur in only trace amounts | 15 |

(con.)

**Table 3.** (Con.)

| | |
|---|---|
| 15. *Carex geyeri, Carex rossii,* and *Stipa occidentalis* (alone or in combination) conspicuous with at least 5% canopy cover | *Populus tremuloides/Symphoricarpos oreophilus/Carex geyeri* c.t. (p. 17) |
| 15. Not as above | 16 |
| 16. *Sitanion hystrix, Stipa comata,* and *Stipa lettermanii* (alone or in combination) conspicuous with at least 5% canopy cover | *Populus tremuloides/Juniperus communis/Sitanion hystrix* c.t. (p. 20) |
| 16. Above grasses usually absent; less than 5% cover if present | 17 |
| 17. *Bromus carinatus* and/or *Elymus glaucus* a conspicuous part of the herbaceous layer, usually with more than 5% cover | *Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus* c.t. (p. 20) |
| 17. *B. carinatus* and *E. glaucus* absent or scarce | 18 |
| 18. *Poa pratensis* and *Taraxacum officinale* among the most prominent perennials in the herbaceous layer | *Populus tremuloides/Symphoricarpos oreophilus/Poa pratensis* c.t. (p. 21) |
| 18. Not as above | Unclassified type |
| AC. (Herb undergrowth type) | |
| 1. *Veratrum californicum* prominent, generally exceeding 5% canopy cover | *Populus tremuloides/Veratrum californicum* c.t. (p. 22) |
| 1. *V. californicum* generally absent; if present, less than 5% canopy cover | 2 |
| 2. *Pteridium aquilinum* usually abundant, with at least 10% canopy cover | *Populus tremuloides/Pteridium aquilinum* c.t. (p. 23) |
| 2. *P. aquilinum* usually absent; if present, then less than 10% cover | 3 |
| 3. *Heracleum lanatum* a conspicuous part of the herbaceous layer with usually more than 5% canopy cover | *Populus tremuloides/Heracleum lanatum* c.t. (p. 22) |
| 3. *H. lanatum* absent or present in only trace amounts | 4 |
| 4. One or more members of the tall forb group readily apparent, alone or in combination forming a conspicuous part of the herbaceous layer | *Populus tremuloides/Senecio serra* c.t. (p. 24) |
| 4. Members of the tall forb group either absent or in total occur in trace amounts | 5 |
| 5. *Festuca thurberi* present with at least 2% canopy cover | *Populus tremuloides/Festuca thurberi* c.t. (p. 27) |
| 5. *F. thurberi* usually absent; if present, then less than 2% cover | 6 |
| 6. *Sitanion hystrix* and/or *Stipa comata* conspicuous with at least 5% canopy cover | *Populus tremuloides/Sitanion hystrix* c.t. (p. 28) |
| 6. *S. hystrix* and *S. comata* usually absent; if present, less than 5% cover | 7 |
| 7. *Carex geyeri, Carex rosii, Carex obtusata, Stipa occidentalis,* or *Calamagrostis rubescens* (alone or in combination) conspicuous with at least 5% cover; *Astragalus miser* often abundant. | *Populus tremuloides/Carex geyeri* c.t. (p. 26) |
| 7. Not as above | 8 |
| 8. *Bromus carinatus* and/or *Elymus glaucus* abundant, usually with at least 10% canopy cover | *Populus tremuloides/Bromus carinatus* c.t. (p. 28) |
| 8. Not as above | 9 |
| 9. *Poa pratensis* and/or *Taraxacum officinale* among the most prominent perennials in the herbaceous layer | *Populus tremuloides/Poa pratensis* c.t. (p. 29) |
| 9. Not as above | Unclassified type |
| B. (*Populus tremuloides-Abies lasiocarpa* cover type) | |
| 1. *Amelanchier alnifolia, Prunus virginiana,* or *Acer grandidentatum* prominent, alone or in combination usually having at least 10% canopy cover; members of the tall forb group usually present | *Populus tremuloides-Abies lasiocarpa/Amelanchier alnifolia* c.t. (p. 31) |
| 1. Not as above | 2 |
| 2. *Vaccinium caespitosum* or *Vaccinium scoparium* abundant, usually well over 10% cover | *Populus tremuloides-Abies lasiocarpa/ Vaccinium caespitosum* c.t. (p. 30) |

(con.)

**Table 3.** (Con.)

| | |
|---|---|
| 2. *V. caespitosum* and *V. scoparium* generally absent; if present, they occur only as incidental species ............... | 3 |
| 3. *Juniperus communis* conspicuous, generally with at least 5% canopy cover ............... | *Populus tremuloides-Abies lasiocarpa/Juniperus communis* c.t. (p. 33) |
| 3. *J. communis* absent or occurring in only trace amounts ....... | 4 |
| 4. *Symphoricarpos oreophilus* usually prominent, at least 10% cover; if scarce or absent, then *Rubus parviflorus* present in greater than trace amounts ............... | 7 |
| 4. Not as above ............... | 5 |
| 5. One or more members of the tall forb group, or *Bromus carinatus* and/or *Elymus glaucus*, a conspicuous part of the herbaceous layer ............... | *Populus tremuloides-Abies lasiocarpa/Senecio serra* c.t. (p. 33) |
| 5. Not as above; these species either absent or occur only incidentally ............... | 6 |
| 6. *Carex geyeri, Carex rossii, Carex obtusata, Stipa occidentalis,* or *Astragalus miser* (alone or in combination) conspicuous, usually with at least 5% canopy cover ...... | *Populus tremuloides-Abies lasiocarpa/Carex geyeri* c.t. (p. 35) |
| 6. Not as above ............... | Unclassified type |
| 7. One or more members of the tall forb group, or *Bromus carinatus* and/or *Elymus glaucus*, a conspicuous part of the herbaceous layer ............... | *Populus tremuloides-Abies lasiocarpa/ Symphoricarpos oreophilus/Senecio serra* c.t. (p. 31) |
| 7. Not as above ............... | 8 |
| 8. *Carex geyeri, Carex rossii, Stipa occidentalis,* or *Astragalus miser* (alone or in combination) conspicuous, usually with at least 5% canopy cover ............... | *Populus tremuloides-Abies lasiocarpa/ Symphoricarpos oreophilus/Carex geyeri* c.t. (p. 32) |
| 8. Not as above ............... | Unclassified type |
| C. (*Populus tremuloides-Abies concolor* cover type) | |
| 1. Both *Symphoricarpos oreophilus* conspicuous (at least 5% cover), and one or more members of the tall forb group or *Bromus carinatus* and/or *Elymus glaucus* a conspicuous part of the herbaceous layer ............... | *Populus tremuloides-Abies concolor/ Symphoricarpos oreophilus* c.t. (p. 36) |
| 1. Not as above ............... | 2 |
| 2. *Juniperus communis* present; members of the tall forb group, *Bromus carinatus,* and *Elymus glaucus* absent or merely incidental ............... | *Populus tremuloides-Abies concolor/Juniperus communis* c.t. (p. 36) |
| 2. Not as above ............... | Unclassified type |
| D. (*Populus tremuloides-Pseudotsuga menziesii* cover type) | |
| 1. *Amelanchier alnifolia, Prunus virginiana,* or *Acer grandidentatum* (alone or in combination) present and usually abundant; *Juniperus communis* absent ............... | *Populus tremuloides-Pseudotsuga menziesii/ Amelanchier alnifolia* c.t. (p. 37) |
| 1. Not as above ............... | 2 |
| 2. *Juniperus communis* present and usually abundant ....... | *Populus tremuloides-Pseudotsuga menziesii/ Juniperus communis* c.t. (p. 37) |
| 2. *J. communis* absent ............... | Unclassified type |
| E. (*Populus tremuloides-Pinus ponderosa* cover type) | |
| 1. *Quercus gambelii, Prunus virginiana,* or *Acer grandidentatum* (alone or in combination) abundant, usually exceeding 10% canopy cover ............... | *Populus tremuloides-Pinus ponderosa/Quercus gambelii* c.t. (p. 38) |
| 1. Above shrubs absent, or present in only incidental amounts ... | 2 |
| 2. *Juniperus communis* present, usually accompanied by *Sitanion hystrix, Stipa comata,* or *Carex rossii* ........... | *Populus tremuloides-Pinus ponderosa/Juniperus communis* c.t. (p. 38) |

(con.)

**Table 3.** (Con.)

| | |
|---|---|
| 2. Not as above | Unclassified type |
| F. (*Populus tremuloides-Pinus contorta* cover type) | |
| 1. *Vaccinium scoparium* or *Vaccinium caespitosum* abundant, usually exceeding 10% canopy cover | *Populus tremuloides-Pinus contorta/Vaccinium scoparium* c.t. (p. 39) |
| 1. *V. scoparium* and *V. caespitosum* absent, or present in only trace amounts | 2 |
| 2. *Juniperus communis* present, usually accompanied by either *Carex geyeri, Carex rossii, Carex obtusata, Stipa occidentalis,* or *Festuca idahoensis* | *Populus tremuloides-Pinus contorta/Juniperus communis* c.t. (p. 40) |
| 2. Not as above | Unclassified type |

# TYPE DESCRIPTIONS

## *Populus tremuloides/Acer grandidentatum/Pteridium aquilinum* Community Type (POTR/ACGR/PTAQ c.t.)

This minor community type was identified on the basis of 11 stands primarily along the Wasatch Range in northern Utah. A single example was encountered in the Uinta Mountains just northwest of Vernal and another in the Pine Valley Mountains in southwestern Utah. The Uinta stand lacked *Acer grandidentatum* but possessed a tall shrub layer dominated by *Amelanchier alnifolia.* The type appeared to favor northerly and easterly exposures at the lower elevations between 5,800 and 7,500 ft (1 770 and 2 290 m). It was usually found on soils derived from sandstones and at the lower toe-slope topographic positions.

The vegetation of this type is characterized by the virtual absence of conifers, a distinct tall shrub layer, and dominance of the herbaceous layer by *Pteridium aquilinum.* Occasional *Abies concolor* or *Abies lasiocarpa* may be present in the tree layer or as reproduction, but not in such abundance to indicate eventual replacement of aspen dominance in the overstory. A tall shrub layer consisting of either *Acer grandidentatum, Prunus virginiana, Amelanchier alnifolia*, or a combination of these shrubs, distinguishes the type from the closely associated POTR/PTAQ c.t., which lacks this shrub layer. The low shrubs *Symphoricarpos oreophilus, Rosa woodsii,* and *Berberis repens* are also frequently present. In addition to the conspicuous dominance of *P. aquilinum* in the undergrowth, other frequently abundant forbs include *Smilacina stellata, Osmorhiza chilensis*, and *Aster engelmannii.* The grasses *Elymus glaucus* and *Bromus carinatus* also frequently provide substantial amounts of cover.

The successional status of this type is uncertain, except that it is unlikely to succeed to conifers. The type may be a grazing-degraded form of the POTR/PRVI/SESE c.t. with which it has many species in common. *P. aquilinum* is not only unpalatable to livestock, it can be poisonous to cattle when eaten in quantity. This unpalatability combined with its ability to spread by creeping rhizomes suggests that it is likely to increase greatly in abundance if its palatable associates are depleted by prolonged excessive grazing. On the other hand, seldom if ever does *P. aquilinum* occur as a minor member of a community. It either tends to dominate the undergrowth or it is absent. This restricted distribution combined with abundance where it does occur suggests that it may have rather specific, and as yet undefined, environmental requirements and represents a distinct climax community type.

Tree productivity in this type generally appears to be moderate to relatively high when compared to other aspen communities. Basal area of aspen ranged from 113 to 174 $ft^2$/acre (25.8 to 40.0 $m^2$/ha), and averaged 136 $ft^2$/acre (31.2 $m^2$/ha). Site index at 80 years ranged from 45 to 69 ft (13.7 to 21.0 m), and averaged 59 ft (18 m). Conifer production was negligible. Aspen suckering beneath the mature overstory was highly variable but averaged a moderate 1,900/acre (4 700/ha); only one-third of these were in the 1- to 4.6-ft (0.3- to 1.4-m) size class.

Undergrowth productivity also varies widely but appears to be generally high. Forage productivity, however, may be low to moderate. A substantial portion of the undergrowth usually consists of the unpalatable fern, *P. aquilinum.* Annual production of undergrowth in the five stands sampled ranged from 836 to 3,792 lb/acre (938 to 4 256 kg/ha) and averaged 2,068 lb/acre (2 320 kg/ha). Over 85 percent of this consisted of forbs (including *P. aquilinum*), with the remainder divided between the shrubs and graminoid vegetation classes. About a third of this undergrowth comprised desirable forage species, a third intermediate, and a third was classified as least desirable. Although the type may have considerable wildlife habitat benefits because of its multilayered cover of trees, tall shrubs, and herbs, livestock grazing values may be only moderate because of the amount of unpalatable species.

Aspen communities containing an abundance of *P. aquilinum* in the undergrowth have also been identified in northwestern Colorado on the west slope of the Park Range by Bunin (1975) and on the White River National Forest by Hoffman and Alexander (1983); neither of these reports indicated the presence of a tall shrub stratum. Hoffman and Alexander (1980), however, describe a *P. tremuloides/P. aquilinum* habitat type for the Routt National Forest in which almost half of the stands contain a tall shrub stratum consisting of *A. alnifolia* or *P. virginiana* or both, a low shrub layer, and a herb layer containing species typical of our POTR/ACGR/PTAQ c.t. The most conspicuous difference was the abundance of *Carex geyeri* in their stands and the absence of this sedge in ours.

## *Populus tremuloides/Prunus virginiana/Senecio serra* Community Type (POTR/PRVI/SESE c.t.)

This is one of the more common community types, especially in northern Utah. Of the 114 stands that we sampled in this type, approximately a third were in the Bear River Range in extreme northern Utah, a third along the Wasatch Range, and about a fourth southward on portions of the Uinta National Forest east of Provo. Only a few scattered stands were found in the southern half of the State. The type occurs most frequently at intermediate elevations; three-fourths of the sampled stands were between 6,000 and 8,000 ft (1 830 and 2 440 m). It occurred most frequently on sandstone- and limestone-derived soils and on moderately steep slopes that had slightly concave to undulating topography. Slope aspect apparently is not restrictive.

The vegetation of this extensive northern Utah type has a pronounced multilayered structure. Below the virtually pure aspen canopy, a layer of tall shrubs, a layer of low shrubs, and a complex of forbs and graminoids contribute to the high degree of structural diversity (fig. 2). The conspicuous presence of either *Prunus virginiana, Amelanchier alnifolia*, and occasionally *Acer grandidentatum* identify this as part of the tall shrub undergrowth type. The low shrub layer is usually dominated by *Symphoricarpos oreophilus*, with lesser amounts of *Rosa woodsii*, and *Berberis repens*; sometimes *Pachistima myrsinites* is conspicuous. *Elymus glaucus* and *Bromus carinatus* are commonly abundant grasses. Tall-growing forbs such as *Senecio serra, Agastache urticifolia, Aster engelmannii*, and *Rudbeckia occidentalis* are prominent in the herbaceous layer. The epithet species *S. serra* need not be present as long as other members of the tall forb group are present in appropriate amounts (refer to key instructions). *Valeriana occidentalis* also may inhabit little-disturbed stands of this type in noticeable abundance. Various species of *Lathyrus* as well as *Vicia americana*, when abundant, occasionally tend to blanket the low shrubs and herbs.

The POTR/PRVI/SESE c.t. usually represents a climax aspen community type, one that reflects a specific aspen habitat type. Conceivably, under active invasion by conifers, stands identified as this type might be considered seral communities on the *Abies lasiocarpa/Osmorhiza chilensis* habitat type described by Mauk and Henderson (1984), based on common occurrence of certain undergrowth species. Abusive grazing within the POTR/PRVI/SESE c.t. would tend to decrease appreciably the amount of palatable forbs and shrubs, and increase the dominance of the grasses *E. glaucus, B. carinatus*, and *Poa pratensis* (sheep grazing), or such forbs as *R. occidentalis, Lathyrus* spp., and *V. americana* (cattle grazing). In some cases, *S. serra* also may increase substantially under cattle use. Extreme and prolonged grazing could lead to a depauperate undergrowth consisting largely of such annuals as *Nemophila breviflora, Polygonum douglasii*, or *Galium bifolium*. Tree productivity on this common type appears to be generally low to moderate, with occasional stands being fairly high. The basal area of aspen on the 42 intensively sampled stands ranged from 45 to 202 $ft^2$/acre (10.4 to 46.4 $m^2$/ha) and averaged 121 $ft^2$/acre (27.9 $m^2$/ha). Site index at 80 years for aspen ranged from 31 to 68 ft (9.4 to 20.7 m) and averaged 47 ft (14.4 m). Usually conifer production was negligible. Aspen reproduction in mature stands ranged from virtually none to over 22,000/acre (55 000/ha). The average was a comparatively high 3,800/acre (9 500/ha). About a third of these suckers were in the 1- to 4.6-ft (0.3- to 1.4-m) size class.

Although quite variable, the undergrowth is generally moderately abundant. Because a high proportion of this undergrowth usually consists of palatable forage plants, the type is fairly productive livestock range. Annual undergrowth production on the sampled stands ranged from 509 to 2,341 lb/acre (572 to 2 627 kg/ha) and averaged 1,141 lb/acre (1 281 kg/ha). This was fairly well distributed among the different vegetation classes: an average 30 percent in the shrub class, 48 percent forbs, and

Figure 2.—The structurally diverse *Populus tremuloides/Prunus virginiana/Senecio serra* c.t. is common in northern Utah. This stand on a southwest exposure in Big Cottonwood Canyon east of Salt Lake City has a dense *P. virginiana* tall shrub layer, a low shrub layer of *Symphoricarpos oreophilus* and *Pachistima myrsinites*, and an herb layer dominated by tall forbs.

22 percent graminoids. Of the undergrowth cover, 95 percent comprised species considered either desirable (55 percent) or intermediately desirable (40 percent) forage plants. Thus, this type is relatively good livestock range and provides good wildlife habitat because of its great amount of structural diversity.

Communities similar to the POTR/PRVI/SESE c.t. are widely encountered in surrounding States. The *P. tremuloides/A. alnifolia-S. oreophilus* c.t. described by Mueggler and Campbell (1982) for southeastern Idaho contains stands similar to our type. Hoffman and Alexander (1980) described a *P. tremuloides/S. oreophilus* habitat type in northwestern Colorado that apparently includes stands similar to our POTR/PRVI/SESE c.t.; about half of the stands within their type have a tall shrub component of *P. virginiana* or *A. alnifolia* or both, a low shrub stratum of *S. oreophilus*, and an herbaceous layer fairly similar to that in our type. Bunin (1975) described a *P. tremuloides/Quercus gambelii—A. alnifolia-Thalictrum fendleri* association on the west slope of the Park Range in Colorado that is similar except for the absence of *Q. gambelii* in our stands. In addition, a *P. tremuloides/S. oreophilus* community with similar tall shrub, low shrub, and tall herbaceous species was observed in northeastern Nevada (Lewis 1975).

## *Populus tremuloides/Prunus virginiana/Carex geyeri* Community Type (POTR/PRVI/CAGE c.t.)

The POTR/PRVI/CAGE c.t. is a minor type that is most prevalent in northern Utah. We sampled 12 stands along the Bear River Mountains, southward along the Wasatch Range, and intermittently eastward along the south slope of the Uinta Mountains. A single stand was in the Pine Valley Mountains in extreme southwestern Utah and one in the Abajo Mountains of southeastern Utah, which reflects its infrequent but wide distribution. The stand in the Abajo Mountains was of questionable placement in this community type. The sampled stands occurred at elevations between 5,500 and 8,700 ft (1 680 and 2 650 m) and did not appear restricted by slope exposure or soil parent material.

The vegetation in this type reflects a somewhat drier environment than either the POTR/PRVI/SESE or POTR/ACGR/PTAQ c.t.'s, the other two tall shrub undergrowth types within this cover type group. Although a variety of conifers may be present, none are abundant. The stands within this community type are structurally diverse with multiple layers of vegetation. Below the aspen overstory exists a tall shrub component in which *Amelanchier alnifolia* or *Prunus virginiana* or both usually predominate; occasionally *Acer grandidentatum* is a major part of this layer. A low shrub layer is usually conspicuous with an abundance of *Symphoricarpos oreophilus* and often substantial amounts of *Berberis repens, Pachistima myrsinites*, and *Rosa woodsii*. The herbaceous layer is characterized by an abundance of the graminoids *Carex geyeri* or *Stipa occidentalis* or both. Species and amounts of forbs vary appreciably but can include considerable amounts of *Thalictrum fendleri, Smilacina stellata, Geranium viscosissimum, Achillea millefolium*, and occasionally *Lupinus argenteus*.

This is primarily a climax community type. In some cases, however, with active invasion of *Abies lasiocarpa*, stands classified in this type might represent seral communities in the *A. lasiocarpa/B. repens* habitat type if in northern Utah (Mauk and Henderson 1984) or in the *A. lasiocarpa/C. geyeri* habitat type if in central or southern Utah (Youngblood and Mauk 1985), judging from species similarity in the undergrowth. Abusive livestock grazing in this type may lead to composition changes that favor *Poa pratensis, Astragalus miser, A. millefolium*, and possibly *Lathyrus* spp.

The potential for wood fiber production on this minor type appears fairly low. Basal area of trees on seven sampled stands ranged from 71 to 155 ft$^2$/acre (16.2 to 35.7 m$^2$/ha), and averaged 104 ft$^2$/acre (23.8 m$^2$/ha). About 98 percent of this basal area was aspen, and 2 percent was conifers. Site index for the aspen at 80 years ranged from 34 to 62 ft (10.4 to 18.9 m) and averaged 46 ft (14.1 m). Aspen reproduction in these mature stands varied greatly, averaging 2,200/acre (5 500/ha). About a third of these were suckers less than 12 inches (3 dm) high and the remainder were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

The undergrowth appears somewhat better suited for cattle than for sheep grazing. Overall productivity is moderate, and forage suitability appears generally good. Current annual growth ranged between 609 and 1,838 lb/acre (684 and 2 062 kg/ha) and averaged 975 lb/acre (1 094 kg/ha). This growth consisted of 46 percent tall and low shrubs, 25 percent forbs, and 29 percent graminoids. Over 95 percent of the undergrowth cover consisted of plants with at least intermediate suitability as livestock forage. Therefore, overall forage production is fairly good. The type has relatively high value as wildlife habitat because of the great amount of structural diversity contributed by the abundant tall and low shrubs.

Types similar to the POTR/PRVI/CAGE c.t. have been noted in southeastern Idaho and in western Wyoming. Mueggler and Campbell (1982) defined a *P. tremuloides/A. alnifolia-Calamagrostis rubescens* c.t. in Idaho, and Youngblood and Mueggler (1981) a *P. tremuloides/P. virginiana* c.t. in Wyoming that structurally and compositionally resembles the Utah type. In both the Idaho and Wyoming types, however, *C. rubescens* is abundant in the herbaceous layer rather than the *C. geyeri* or *S. occidentalis* or both that are present in the Utah type.

## *Populus tremuloides/Sambucus racemosa* Community Type (POTR/SARA c.t.)

Although this is a relatively minor community type, it is fairly well distributed over the higher mountains of Utah. The 16 stands sampled occurred primarily on the Wasatch-Cache, Uinta, and Manti-LaSal National Forests. The type appeared most frequently on midslope to upper-slope positions on sedimentary soils. All but one of the stands occurred at elevations exceeding 8,000 ft (2 440 m). Half the stands grew at elevations over 9,000 ft (2 740 m).

*Abies lasiocarpa* and *Picea engelmannii* occasionally are found in this type but never in abundance. *Sambucus*

*racemosa* or *S. cerulea* form a conspicuous part of the undergrowth; other shrubs are generally scarce, with the possible exception of *Salix scoulerana*. The grasses *Bromus carinatus* and *Agropyron trachycaulum* are usually present and sometimes abundant. Certain members of the tall forb group, such as *Mertensia arizonica, Delphinium occidentale, Osmorhiza occidentalis, Polemonium foliosissimum*, and *Rudbeckia occidentalis*, are often conspicuous and may be abundant, as are *Thalictrum fendleri* and *Valeriana occidentalis*.

Although the successional status is uncertain, the type probably reflects a distinct environment or habitat type. Coniferous forests adjacent to these high elevation communities usually are dominated by *A. lasiocarpa*. Prolonged overgrazing can lead to a change in undergrowth composition that favors *M. arizonica* (if grazed midsummer or late summer), *R. occidentalis*, and possibly *Lathyrus* spp. Overgrazing will also increase the amount of exposed soil and such annuals as *Nemophila breviflora, Polygonum douglasii*, and *Galium bifolium*.

The type is relatively productive for trees, even though aspen apparently does not reproduce well beneath the existing canopy. Tree basal area on eight sampled stands ranged from 70 to 211 $ft^2$/acre (16.1 to 48.5 $m^2$/ha) and averaged 150 $ft^2$/acre (34.5 $m^2$/ha). Virtually all of this consisted of aspen. Aspen site index at 80 years was moderate, averaging 54 ft (16.5 m) and ranging from 38 to 65 ft (11.6 to 19.8 m). Aspen suckers averaged only about 900/acre (2 200/ha), with two-thirds in the 1- to 4.6-ft (0.3- to 1.4-m) size class.

The undergrowth typically consists of a moderately productive mixture of shrubs, forbs, and grasses. Annual production ranged from 491 to 1,924 lb/acre (552 to 2 159 kg/ha) and averaged 1,072 lb/acre (1 204 kg/ha). Of this, 35 percent was shrubs, 52 percent forbs, and 13 percent graminoids. About half of the undergrowth consisted of desirable forage species and a third was of intermediate forage suitability. The type appears to have relatively moderate value both as livestock range and as wildlife habitat.

Although *S. racemosa* and *S. cerulea* may occur occasionally as minor shrubs in aspen stands elsewhere, they have not been reported before as major species characterizing a specific community type.

## *Populus tremuloides/Symphoricarpos oreophilus/Senecio serra* Community Type (POTR/SYOR/SESE c.t.)

The POTR/SYOR/SESE c.t. was the most frequently encountered aspen type in Utah—almost 12 percent of stands sampled. It appears to be a predominantly northern Utah community type; over three-fourths of the stands were on the Wasatch-Cache and Uinta National Forests (fig. 3). The majority were encountered on the Bear River and Wasatch Ranges. Stands were also found in the San Pitch Mountains, the Pavant Range, and occasionally in the Abajo and LaSal Mountains. It was conspicuously absent from the high plateaus of southern Utah.

This is typically an intermediate-elevation community type that clearly demonstrates the effect of latitude upon elevational distribution of a plant community. On the Wasatch-Cache National Forest in northern Utah, stands within this type occurred at elevations between 6,200 and 8,800 ft (1 890 and 2 680 m). On the Manti-LaSal National Forest in central Utah, an average 2° latitude farther south, the type in general occurred at elevations about 1,000 ft (300 m) higher, between 7,700 and 9,700 ft (2 350 and 2 960 m) elevation. The type appeared most frequently on slopes of less than 25 percent steepness and on soils derived from sedimentary parent materials, primarily sandstones.

The POTR/SYOR/SESE c.t. vegetation consists of three distinct strata: an overstory of pure aspen, a low shrub layer, and an herbaceous layer of a rich mixture of tall and low-growing plants. Tall shrubs such as *Amelanchier alnifolia* and *Prunus virginiana* occasionally may be present, but they are never abundant. The low shrub stratum is dominated exclusively by *Symphoricarpos oreophilus*. The herbaceous undergrowth is typified by a tall forb mixture that varies considerably between stands. The most commonly associated tall forbs are *Rudbeckia occidentalis, Senecio serra, Agastache urticifolia, Mertensia arizonica, Aster engelmannii*, and *Polemonium foliosissimum*. The forb *S. serra* was selected to represent this tall forb complex in the type name, even though it is not present in all stands within the type. Other forbs frequently present in substantial amounts include *Hackelia floribunda, Osmorhiza chilensis, Thalictrum fendleri*, and *Valeriana occidentalis*. Usually the prominent grasses are *Bromus carinatus, Agropyron trachycaulum*, and *Elymus glaucus*. Species diversity within this community type is often great.

We consider this primarily an extensive climax community type, thus representing a distinct aspen habitat type. The presence of conifers is usually accidental. However, when stands are classified to this type because of current lack of conifers, yet conifers appear able to actively invade, such stands likely will be successional within the *Abies lasiocarpa/O. chilensis* habitat type in northern Utah (Mauk and Henderson 1984) or within the *A. lasiocarpa/Aconitum columbianum* habitat type in central Utah (Youngblood and Mauk 1985). Abusive livestock grazing usually simplifies the undergrowth appreciably. Extended heavy use by sheep will likely shift species composition from the more palatable tall forbs and *S. oreophilus* to that dominated by *E. glaucus, B. carinatus*, and possibly *Poa pratensis*. Eventually it could change to a depauperate condition where only unpalatable perennials and such annuals as *Nemophila breviflora, Polygonum douglasii*, and *Collomia linearis* remain. Excessive cattle grazing may shift composition to dominance by *R. occidentalis, Vicia americana, Lathyrus* spp., and possibly *M. arizonica*, and then to a depauperate annual condition if such abuse persists. The dense blanket of *V. americana* and *Lathyrus* spp. sometimes found in these stands probably is an artifact of past livestock use.

The amount of wood produced in this common community type varies greatly between stands. In general, the type is relatively low in fiber production. The tree basal area on 42 stands ranged between 14 and 233 $ft^2$/acre

Figure 3.—The *Populus tremuloides/Symphoricarpos oreophilus/Senecio serra* c.t. such as this stand on the Uinta National Forest near the Payson Guard Station, is a prominent northern Utah aspen type. The undergrowth generally consists of a rich mixture of tall and low forbs, graminoids, and low shrubs dominated by *S. oreophilus*.

(3.3 and 53.4 $m^2$/ha) and averaged 115 $ft^2$/acre (26.4 $m^2$/ha). Only 2 percent of this basal area consisted of conifers. Aspen site index at 80 years ranged from 26 to 71 ft (7.9 to 21.6 m) and averaged a moderately low 48 ft (14.5 m). Aspen reproduction in these mature stands was about equally divided between suckers less than 1 ft (0.3 m) high and those over this height. Number of suckers was highly variable, from almost complete absence to over 20,000/acre (50 000/ha), but averaged a moderate 2,700/acre (6 600/ha).

The quantity of undergrowth is also variable but generally consists of a fairly productive mixture of different vegetation classes. Annual production averaged 1,340 lb/acre (1 504 kg/ha) and ranged from 386 to 2,654 lb/acre (434 to 2 956 kg/ha). An average 20 percent of this consisted of shrubs, principally *S. oreophilus*, 55 percent of forbs, and 25 percent of graminoids. Almost 90 percent of the undergrowth was comprised of species that are considered desirable (51 percent) or of intermediate forage suitability (37 percent). The type, therefore, is fairly good summer range for both sheep and cattle. Wildlife habitat values may be less than optimum because of the lack of a tall shrub layer.

Aspen communities with undergrowth of only a low shrub stratum primarily of *S. oreophilus* and an herbaceous layer with good representation of tall forbs are fairly widespread. Mueggler and Campbell (1982) described a *P. tremuloides/S. oreophilus-R. occidentalis* c.t. in southeastern Idaho that is similar to our Utah type except their stands appear to be more severely altered by abusive grazing. A *P. tremuloides/S. oreophilus* c.t. was identified for western Wyoming that is also fairly similar (Youngblood and Mueggler 1981). About a third of the stands in the more generalized *P. tremuloides/ S. oreophilus* habitat type described for the Routt National Forest (Hoffman and Alexander 1983) and about a fourth of those in the *P. tremuloides/S. oreophilus* habitat type described for the White River National Forest (Hoffman and Alexander 1980) in northwestern Colorado appear structurally and compositionally similar to our POTR/SYOR/ SESE c.t.

## *Populus tremuloides/Symphoricarpos oreophilus/Carex geyeri* Community Type (POTR/SYOR/CAGE c.t.)

This relatively common community type is widely distributed across all National Forests in Utah. Stands were encountered at elevations ranging from 6,100 to 9,400 ft (1 860 to 2 870 m). The type occurred on all exposures on mountain slopes usually less than 25 percent in steepness. About half the stands in this type grew on soils of sandstone origin, and about a fourth on granitic soils.

The indicator species *Carex geyeri, Carex rossii*, and *Stipa occidentalis* are believed to reflect similar environmental situations, yet they do not necessarily frequent the same geographical areas. *Carex geyeri* is a primary undergrowth component only on the Uinta, Ashley, and Manti-LaSal National Forests; *C. rossii* and *S. occidentalis* prevail as indicator species on the Fishlake and Dixie National Forests where *C. geyeri* is usually absent. This presents a dilemma in naming community types: either we unnecessarily increase the number of community type names, or we select a single species to reflect the undergrowth portion of the epithet even though it may not be present in all areas. We have chosen the latter; *C. geyeri* is used in the epithet to represent all three species of graminoids.

The POTR/SYOR/CAGE c.t. has a considerably less diverse assemblage of species than the POTR/SYOR/ SESE c.t. Both types are essentially three layered, with an aspen-dominated overstory, and a *Symphoricarpos oreophilus* shrub stratum. The herbaceous undergrowth in the POTR/SYOR/CAGE c.t., however, is less complex. This undergrowth usually has an abundance of graminoids accompanied by low-growing forbs. As noted above, we consider *C. geyeri, C. rossii*, and *S. occidentalis* to more or less indicate equivalent abiotic environments, even though they may react somewhat differently to disturbance such as grazing. Frequently *Agropyron trachycaulum* and *Poa pratensis* are also common graminoids. Some of the more common forbs include

*Thalictrum fendleri, Lupinus argenteus,* and *Geranium viscosissimum.* The dominant *S. oreophilus* in the shrub layer is frequently accompanied by *Rosa woodsii* and *Berberis repens.*

We believe that this type is essentially a climax community type representing a fairly broad POTR/SYOR/CAGE habitat type. The occasional presence of *Pseudotsuga menziesii* or *Abies lasiocarpa* and associated species suggests that it may also be considered a seral community within either of those coniferous forest series, possibly the *P. menziesii/S. oreophilus, P. menziesii/B. repens,* or *A. lasiocarpa/B. repens* habitat types (Mauk and Henderson 1984; Youngblood and Mauk 1985). Overgrazing within the POTR/SYOR/CAGE c.t. probably shifts community composition toward greater abundance of *Poa pratensis, Sitanion hystrix, Astragalus miser, Taraxacum officinale,* and *Achillea millefolium.*

This type has a fairly high potential for wood production, yet only moderate potential for the production of undergrowth. Tree basal area on 14 sampled stands ranged from 74 to 292 ft$^2$/acre (16.9 to 67.0 m$^2$/ha) and averaged 165 ft$^2$/acre (37.8 m$^2$/ha). Virtually all of this consisted of aspen. Site index at 80 years for aspen ranged from 35 to 75 ft (10.7 to 22.9 m) and averaged a moderate 50 ft (15.3 m). Aspen suckers averaged a moderate 1,700/acre (4 100/ha), slightly over half of which were in the 1- to 4.6-ft (0.3- to 1.4-m) size class.

Annual production of undergrowth ranged from 331 to 1,990 lb/acre (372 to 2 234 kg/ha), and averaged a moderate 1,071 lb/acre (1 202 kg/ha). This production was divided among major vegetation classes as follows: 23 percent shrubs, 44 percent forbs, and 33 percent graminoids. Over 50 percent of the vegetation fell into the desirable forage suitability class, and less than 10 percent was in the least desirable class. The type is relatively good livestock summer range, perhaps more suited to cattle than to sheep. The lack of a tall shrub stratum reduces structural diversity and consequently somewhat diminishes the value of the type as wildlife habitat.

Aspen communities similar to this type have been observed elsewhere. Schlatterer (1972) identified a *P. tremuloides/S. oreophilus-C. geyeri* habitat type in the Sawtooth area of south-central Idaho. A similar *P. tremuloides/S. oreophilus-Calamagrostis rubescens* community type, with *C. rubescens* replacing *C. geyeri* as the principal graminoid, occurs in southeastern Idaho (Mueggler and Campbell 1982). Some of the stands occurring in the generalized *P. tremuloides/S. oreophilus* habitat type in northwestern Colorado (Hoffman and Alexander 1983) resemble those in our POTR/SYOR/SESE c.t.

## *Populus tremuloides/Symphoricarpos oreophilus/Festuca thurberi* Community Type (POTR/SYOR/FETH c.t.)

This minor type, sampled by only seven stands, is restricted to central and southern Utah. Three stands were encountered on the Fishlake Plateau and four on the Aquarius Plateau. These stands were at elevations between 8,600 and 9,400 ft (2 620 and 2 870 m) and on soils derived either from volcanic or granitic parent materials.

The type is characterized by a distinct shrub layer dominated by *Symphoricarpos oreophilus* and a rather simple herbaceous layer in which *Festuca thurberi* is a conspicuous dominant. Although conifers are not abundant, *Pseudotsuga menziesii* frequently will be found in this type. The shrub stratum often contains appreciable amounts of *Berberis repens* and *Rosa woodsii.* Grasses that may be abundantly associated with *F. thurberi* include *Bromus anomalus* and *Stipa occidentalis.* Forbs are ordinarily sparse; those most likely to form a substantial part of the undergrowth are *Lathyrus* spp., *Vicia americana, Taraxacum officinale,* and *Thalictrum fendleri.*

The few stands sampled in the POTR/SYOR/FETH c.t. appeared to reflect considerable past grazing pressure, judging from the abundance of *T. officinale, V. americana,* and *Lathyrus* spp. The type appears to represent primarily a POTR/SYOR/FETH habitat type, but with appreciably altered species composition. The amount of *P. menziesii* occurring in some stands suggests that they may be seral within the *P. menziesii* forest series.

Only two stands within this type were sampled to assess productivity. This limited sample suggests that wood fiber production is relatively high. Tree basal area was 160 and 178 ft$^2$/acre (36.8 and 40.9 m$^2$/ha), and the 80-year site index for aspen was 52 and 63 ft (15.8 and 19.2 m). Virtually all of the basal area was aspen. Reproduction of aspen in these mature stands was very low, averaging less than 180 suckers/acre (450/ha).

Undergrowth production was a relatively low 405 and 774 lb/acre (455 and 869 kg/ha). A high proportion of this, an average 56 percent, consisted of shrubs, 27 percent was forbs, and 17 percent was graminoids. A high proportion of the undergrowth consisted of vegetation in the desirable and intermediate forage suitability categories. Thus, although the type appears to produce high quality livestock forage, the quantity is relatively low. The absence of a tall shrub layer somewhat reduces the value of this type as wildlife habitat.

Langenheim (1962) reported aspen stands with the tussock *F. thurberi* as a major grass component in the undergrowth in only one other location, the Crested Butte area of west-central Colorado. Some of the communities she described contained a low shrub stratum dominated by *S. oreophilus* and an herbaceous layer with appreciable amounts of *F. thurberi.*

## *Populus tremuloides/Juniperus communis/Carex geyeri* Community Type (POTR/JUCO/CAGE c.t.)

The POTR/JUCO/CAGE type was encountered principally on the Wasatch-Cache and Ashley National Forests where 70 stands were sampled. Over three-fourths of the occurrences were in the Uinta Mountains of northeastern Utah. The type was occasionally encountered in central and southern Utah on the Fishlake and Aquarius Plateaus and in the Tushar Mountains. *Carex rossii* and *Stipa occidentalis* were the equivalent indica-

tor graminoids in these more southerly locations rather than *Carex geyeri* (see the POTR/SYOR/CAGE c.t. section). The type usually occurred at the intermediate and upper elevations ranging from 7,500 to 9,100 ft (2 290 to 2 770 m). Although the type was found most frequently on gentle slopes, it does not appear to be restricted by either slope exposure or soil parent material.

The characterizing species for the type are the conspicuous *Juniperus communis* in the shrub stratum and the dominant graminoids *C. geyeri* or *S. occidentalis* or both in the herb stratum (fig. 4). In central and southern Utah, *C. rossii* usually replaces *C. geyeri* in the association. *Juniperus communis* generally grows as distinct low, compact clumps widely scattered beneath the aspen canopy. These clumps frequently are interspersed with *Symphoricarpos oreophilus* and *Berberis repens*, which may form a substantial part of the shrub layer. The herb layer usually is fairly simple. In addition to the typifying graminoids, such forbs as *Astragalus miser, Geranium viscosissimum, Lupinus argenteus, Achillea millefolium*, and *Thalictrum fendleri* may grow in substantial amounts. Conifers, usually *Pinus contorta* or *Pseudotsuga menziesii*, are occasionally present in minor amounts.

Stands within this type are ordinarily in a stable aspen condition. In those cases where conifers appear able to invade, the stands may be a successional stage within the *Abies lasiocarpa/J. communis, A. lasiocarpa/B. repens*, or possibly *P. menziesii/B. repens* habitat types described by Mauk and Henderson (1984). Excessive livestock grazing will likely lead to substantial increases in the amount of *Taraxacum officinale, A. miser, A. millefolium*, and possibly *J. communis* at the expense of the more palatable and less tenacious forage species.

Although the average basal area produced by aspen within this type appears moderate, its site index is low. Basal area of the 11 stands sampled for productivity ranged from 47 to 234 ft$^2$/acre (10.9 to 53.6 m$^2$/ha) and averaged 146 ft$^2$/acre (33.5 m$^2$/ha). This basal area was 98 percent aspen. Site index at 80 years for the aspen ranged from 23 to 68 ft (7.0 to 20.7 m) and averaged a low 45 ft (13.7 m). Aspen reproduction within these stands was also low, averaging only 896 suckers/acre (2 215/ha). Two-thirds of these suckers were in the 1- to 4.6-ft (0.3- to 1.4-m) height class. The amount of undergrowth production within this type is relatively low and rather evenly distributed among the different vegetation categories. Total production ranged from 141 to 1,031 lb/acre (158 to 1 158 kg/ha) and averaged only 597 lb/acre (670 kg/ha). This consisted of 42 percent graminoids, 4 percent forbs, and the remainder was shrubs. Of the undergrowth, 53 percent was in the highest forage suitability class, and almost 10 percent was in the lowest class. The type has relatively low potential for livestock forage production. Value as habitat for wildlife appears only moderate because of its modest amount of structural diversity.

Aspen communities with a low shrub layer dominated by *J. communis* have been reported from two separate areas in Wyoming. Wirsing and Alexander (1975) identified a *P. tremuloides/C. geyeri* habitat type on the Medicine Bow National Forest in southeastern Wyoming similar to our type in that *J. communis* was the principal shrub and *C. geyeri* characterized the herbaceous layer. However, their type differed by the absence of *S. oreophilus* and abundance of *Arnica cordifolia* and *Osmorhiza depauperata*. A *P. tremuloides/J. communis* community type was described for western Wyoming (Youngblood and Mueggler 1981) in which *J. communis* dominated the shrub layer, but differed from our type by the prominence of the associated shrub *Shepherdia canadensis* and by the lack of characterizing graminoids in the rather depauperate herbaceous layer.

**Figure 4.—The *Populus tremuloides/Juniperus communis/Carex geyeri* c.t. is prominent in the Uinta Mountains of northeastern Utah. In this typical stand near the Kaler Hollow Guard Station on the Ashley National Forest, *J. Communis* is the conspicuous low shrub. The herbaceous growth consists primarily of such graminoids as *C. geyeri* and such forbs as *Astragalus miser* and *Lupinus argenteus*.**

## *Populus tremuloides/Juniperus communis/ Sitanion hystrix* Community Type (POTR/JUCO/SIHY c.t.)

Though not common, this community type was encountered intermittently across most of the National Forests of Utah. We sampled 21 stands within the type. The type occurred most frequently in the Uinta Mountains in northeastern Utah but extended southward to the Aquarius and Markagunt Plateaus in southern Utah. This is a mid-elevation type with over 80 percent of the stands in the 8,000 to 9,000 ft (2 440 to 2 740 m) elevation zone. Most of the stands grew on soils derived either from granite or sandstone.

Vegetation in the POTR/JUCO/SIHY c.t. reflects a drier environment than that occupied by the POTR/JUCO/CAGE c.t. The shrub layer is typified by the dominance of *Juniperus communis* or *Artemisia tridentata* or both. Other shrubs frequently present in noticeable amounts are *Symphoricarpos oreophilus* and *Berberis repens*. The herbaceous undergrowth is comparatively poor and is typified by the substantial presence of one or more of the grasses *Sitanion hystrix, Stipa comata*, and *Stipa lettermanii*. Forbs are generally sparse. Most frequently encountered are *Achillea millefolium, Taraxacum officinale*, and *Lupinus argenteus*. The latter at times forms the major part of the undergrowth biomass.

This community type is primarily a relatively dry-site, stable aspen type. In some situations, where *Pinus ponderosa* or *Pseudotsuga menziesii* are actively invading the aspen stand, the type may be a seral stage within the *P. ponderosa/Festuca idahoensis* habitat type in northern Utah (Mauk and Henderson 1984), or possibly the *P. menziesii/B. repens* habitat type farther south (Youngblood and Mauk 1985). Abusive grazing in this type could lead to an increase in the shrubs *A. tridentata* and *J. communis*, the forbs *A. millefolium* and *T. officinale*, and possibly in the grass *Poa pratensis*.

Production was not measured in this type. It probably is a less productive livestock range and wildlife habitat than the POTR/JUCO/CAGE c.t. because of a drier environment and lower proportion of vegetation in the desirable forage suitability class. Wood production is also likely below that of the POTR/JUCO/CAGE c.t. Undergrowth production probably averages less than 535 lb/acre (600 kg/ha) and tree production less than 130 $ft^2$/acre (30 $m^2$/ha).

Although aspen communities with a low shrub layer dominated by *J. communis* have been reported elsewhere (Youngblood and Mueggler 1981; Wirsing and Alexander 1975), none have herbaceous undergrowth composition similar to that in our POTR/JUCO/SIHY c.t.

## *Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus* Community Type (POTR/SYOR/BRCA c.t.)

This infrequent community type was represented by only 12 stands principally in northern Utah on the Bear River and Wasatch Ranges. One stand was in the Abajo Mountains in southeastern Utah. The type occurred at elevations ranging from 6,400 to 8,600 ft (1 950 to 2 620 m), on all exposures, but primarily on sandstone and quartzite derived soils.

Vegetation of the POTR/SYOR/BRCA c.t. reflects appreciable alteration because of livestock grazing. The vegetation consists essentially of three strata: trees, low shrubs, and herbs. The tree layer is virtually pure aspen; conifers are present occasionally but only in minor amounts. The shrub layer may be a mixture of various species, but *Symphoricarpos oreophilus* is the only one that has both high constancy and abundance. *Amelanchier alnifolia* and other tall shrubs sometimes may be present but never in sufficient abundance to form a definite stratum of tall shrubs. The herbaceous undergrowth is characterized by the abundance of the tall grasses *Bromus carinatus* or *Elymus glaucus* or both; *Agropyron trachycaulum* is usually present in substantial quantities. Although a variety of forbs may be present in any one stand, constancy between stands of any single species is generally low. *Geranium viscosissimum* and *Lathyrus* spp. appear to be the most representative forbs.

We believe that this type is primarily a seral stage leading to a climax aspen POTR/SYOR/SESE c.t. The paucity of tall forbs that commonly exist in the POTR/SYOR/SESE c.t. and the proportionately greater role of *B. carinatus* and *E. glaucus* in the undergrowth are attributed to grazing influences, probably by sheep. Heavy, continued grazing pressure could lead to yet more pronounced changes, such as a decrease in *S. oreophilus*, a replacement of desirable perennial herbs with yet greater amounts of *Poa pratensis, Taraxacum officinale*, and possibly *Lathyrus* spp. Where conifers appear able to actively invade, such stands may be a seral stage in the *Abies lasiocarpa/Osmorhiza chilensis* habitat type (Mauk and Henderson 1984).

Only two stands were sampled for productivity. Based on this small sample, wood production appears to be fairly low. Basal area of trees was a low 97 and 109 $ft^2$/acre (22.3 and 25.1 $m^2$/ha); 94 percent of this was aspen and the remainder was conifers. Aspen site index at 80 years was a moderate 48 and 62 ft (14.6 and 18.9 m). Aspen reproduction was moderate at approximately 2,600 suckers/acre (6 500/ha), almost 40 percent of which were 1 to 4.6 ft (0.3 to 1.4 m) high.

Undergrowth production was low to moderate. Total production within the two stands was 463 and 1,583 lb/acre (519 and 1 777 kg/ha). This was distributed among vegetation classes as follows: 12 percent shrubs, 29 percent forbs, and 59 percent graminoids. Of the total undergrowth, 97 percent was in the desirable and intermediate forage suitability groups. This seral type produces less forage of a considerably different character than the successionally related POTR/SYOR/SESE c.t.,

which tends to be dominated by tall forbs rather than by grasses. The POTR/SYOR/BRCA c.t. is relatively good range for cattle and somewhat less desirable for sheep because of the prominence of grasses. The absence of a tall shrub stratum and somewhat meager stratum of low shrubs restricts the value of this type as wildlife habitat.

This specific seral community type has not been reported elsewhere. However, it is believed to represent a grazing-degraded type leading to a POTR/SYOR/SESE climax community type, which appears rather widespread. Communities similar to POTR/SYOR/SESE type occur in southeastern Idaho (Mueggler and Campbell 1982), western Wyoming (Youngblood and Mueggler 1981), and western Colorado (Hoffman and Alexander 1980, 1983).

## *Populus tremuloides/Symphoricarpos oreophilus/Poa pratensis* Community Type (POTR/SYOR/POPR c.t.)

We identified the POTR/SYOR/POPR c.t. on the basis of 30 sampled stands widely scattered from the Bear River Range in extreme northern Utah to the Abajo Mountains in the southeast and the high plateaus in southwestern Utah. The stands were at elevations as low as 6,000 ft (1 830 m) in northern Utah, but were between 7,500 and 8,800 ft (2 290 and 2 680 m) in southern Utah. These stands generally occupied shallow slopes, a wide variety of exposures, and grew on all soils except those derived from granitic parent material.

The vegetation appears considerably degraded by abusive grazing. Although a wide variety of species may be encountered in different stands within this type, few are constant, much less prominent. The vegetation of the type is characterized by the presence of a low shrub layer dominated by *Symphoricarpos oreophilus* and an herb layer comprised predominantly of *Poa pratensis* and *Taraxacum officinale*. Most frequently associated with these are *Berberis repens, Agropyron trachycaulum, Achillea millefolium*, and *Lupinus argenteus*.

The type is a result of a long history of intensive grazing of what probably once were climax POTR/SYOR/CAGE or POTR/SYOR/SESE community types. Although both *P. pratensis* and *T. officinale* are palatable to cattle and sheep, their growth characteristics enable them to withstand intensive grazing remarkably well. These two species are able to increase under abusive grazing because of reduced competition from the more grazing-sensitive species that are equally or even less palatable to livestock. Continued abusive grazing probably will cause depletion of *S. oreophilus* and conversion to a POTR/POPR c.t.

Overall productivity of both trees and undergrowth in this type appears low to moderate. Tree basal area, all aspen, ranged from 96 to 160 ft$^2$/acre (22.0 to 36.7 m$^2$/ha) and averaged 117 ft$^2$/acre (26.9 m$^2$/ha). Aspen site index at 80 years ranged from 43 to 50 ft (13.1 to 15.2 m) and averaged 47 ft (14.2 m). Aspen reproduction in the sampled stands averaged a low 890 suckers/acre (2 200/ha); two-thirds of these were in the 1- to 4.6-ft (0.3- to 1.4-m) size class.

Undergrowth production ranged from 426 to 1,240 lb/acre (479 to 1 391 kg/ha) and averaged a low to moderate 929 lb/acre (1 042 kg/ha). This was equally distributed among shrubs, forbs, and graminoids. Only 30 percent of the undergrowth was rated as desirable; 65 percent was rated as intermediate forage suitability. Presumably this community type, degraded by abusive livestock grazing, was once considerably more productive of forage than at present. Both overall production and species diversity have undoubtedly decreased. Value of the type as wildlife habitat appears only moderate because of limited structural and low species diversity.

This grazing-induced type is similar to the *P. tremuloides/S. oreophilus-P. pratensis* seral type in southeastern Idaho reported by Mueggler and Campbell (1982).

## *Populus tremuloides/Juniperus communis/ Astragalus miser* Community Type (POTR/JUCO/ASMI c.t.)

The POTR/JUCO/ASMI c.t. is a minor and fairly local type that was observed only in the Uinta Mountains of northern Utah. We sampled 10 stands, primarily on easterly and southerly exposures, at relatively high elevations ranging from 8,300 to 9,300 ft (2 530 to 2 830 m). The stands were restricted to sedimentary soils derived from quartzite, sandstone, and limestone parent material.

The vegetation of this type can have considerable species diversity. Occasional conifers may be present, particularly *Pinus contorta*, but they are never abundant. A pronounced low shrub layer is present, usually consisting of a mixture in which *Juniperus communis* is a constant and usually dominant or codominant species. The shrubs *Symphoricarpos oreophilus* and *Berberis repens* frequently occur; in some stands *Arctostaphylos uva-ursi* or *Artemisia tridentata* may be abundant. The herb stratum is typified by the relative abundance of *Astragalus miser*. Other frequently encountered forbs include *Achillea millefolium, Taraxacum officinale*, and *Antennaria microphylla*. Graminoids usually are fairly scarce, with *Agropyron trachycaulum, Leucopoa kingii*, and *Bromus ciliatus* most frequently present.

Judging from the usual abundance of *A. miser, A. millefolium*, and *T. officinale*, this appears to be a seral type created by overgrazing. Occupancy of relatively dry sites and similarities in species composition suggest that the type may be a degraded version of the POTR/JUCO/CAGE c.t. Stands within the type susceptible to *Abies lasiocarpa* invasion may be seral and grazing-altered communities within the *A. lasiocarpa/ B. repens* or *A. lasiocarpa/J. communis* habitat types described by Mauk and Henderson (1984).

This type was not sampled for production. However, its successional relationship to the POTR/JUCO/CAGE c.t. suggests that wood productivity is probably fairly low with an aspen site index at 80 years less than 46 ft (14 m). Average undergrowth productivity is also probably quite low, less than 580 lb/acre (650 kg/ha). This undergrowth consists of a high proportion of species that are intermediate to low in forage suitability. The

combination of low productivity and low suitability makes this type poor livestock range. For similar reasons, plus limited structural diversity, the type probably provides relatively poor wildlife habitat.

Aspen communities with a low shrub layer dominated by *J. communis* have been reported for Wyoming (Youngblood and Mueggler 1981; Wirsing and Alexander 1975), but none have herbaceous undergrowth similar to this Utah type.

## *Populus tremuloides/Veratrum californicum* Community Type (POTR/VECA c.t.)

This is a scarce yet identifiably unique community type. We sampled only two stands, one on the north slope of the Uintas in the upper Bear River drainage and the other in the San Pitch Mountains east of Santaquin. These stands occupied moist sites on heavy, deep soils with poor moisture drainage.

The type is readily recognized by an undergrowth dominated by *Veratrum californicum*, a tall, coarse forb. Shrubs are either absent or occur in only trace amounts, thus the vegetation is structurally simple. Associated herbaceous species are those that grow well under fairly moist site conditions, such as *Carex hoodii*, *Phleum alpinum*, and *Rudbeckia occidentalis*.

This appears to represent a climax community type or habitat type. Heavy grazing probably results in an increase in *V. californicum* and *R. occidentalis* at the expense of the more palatable graminoids.

The single stand sampled for productivity within this type suggests that although tree basal area may be low, aspen growth is rapid on these moist sites. Tree basal area in the stand was 71 ft$^2$/acre (16.4 m$^2$/ha) and aspen site index at 80 years was 70 ft (21.3 m). Aspen reproduction was a moderate 2,300 suckers/acre (5 700/ha), two-thirds of which were in the 1- to 4.6-ft (0.3- to 1.4-m) size class.

Undergrowth production can be high because lack of soil moisture seldom restricts plant growth. The sampled stand produced 1,582 lb/acre (1 775 kg/ha). Forbs accounted for 34 percent of this, graminoids 65 percent, and shrubs only 1 percent. The type is not very good for livestock grazing because of species composition. Although our sample indicates that 59 percent of the undergrowth consists of vegetation in the desirable and intermediate forage suitability classes, this can be misleading when applied to all stands within the type. *Veratrum californicum* has the potential to exclusively dominate the undergrowth on some sites. When this occurs, the undergrowth has little value as livestock forage. Lack of structural and species diversity limits the value of this type as wildlife habitat.

Although scarce, this type is fairly widespread. Hoffman and Alexander (1980) described a *P. tremuloides/ Veratrum tenuipetalum* habitat type on the Routt National Forest in northwestern Colorado, which is also restricted to wet sites. According to Harrington (1954), *V. tenuipetalum* and *V. californicum* are synonymous.

## *Populus tremuloides/Heracleum lanatum* Community Type (POTR/HELA c.t.)

Although not encountered frequently, representatives of the POTR/HELA c.t. were found from the Bear River Range in extreme northern Utah southward to the Fishlake Plateau in central Utah. We sampled 14 stands that generally occupied fairly shallow slopes on northerly and easterly exposures. The type was primarily on soils derived from sandstone, but it also occurred on limestone, quartzite, and volcanics. Elevations ranged from approximately 7,000 to 9,300 ft (2 130 to 2 830 m). These sites were fairly moist but not as moist as those occupied by the POTR/VECA c.t.

The vegetation in this type consists of only two distinct strata: the aspen overstory and a diverse herbaceous undergrowth. Occasional shrubs, primarily *Symphoricarpos oreophilus* and *Sambucus racemosa*, may be present but are never abundant. The undergrowth usually is dominated by a mixture of tall-growing forbs of which *Heracleum lanatum* is a conspicuous constant and usually abundant typifying species (fig. 5). Other forbs frequently prominent in this type include *Rudbeckia occidentalis, Senecio serra, Polemonium foliosissimum, Mertensia arizonica, Valeriana occidentalis*, and *Delphinium occidentale*. Frequent and sometimes abundant grasses include *Bromus carinatus* and *Elymus glaucus*.

This appears to represent a fairly moist, climax community type. Many of the tall forbs found in the type, and especially *H. lanatum*, are palatable to both sheep and cattle. Abusive grazing by either class of livestock probably will result in a decrease of *H. lanatum* and other palatable forbs with an accompanying increase in *R. occidentalis, Vicia americana, Lathyrus* spp., and possibly *S. serra*. Continued abuse would tend to eliminate the palatable perennials and encourage occupancy by such annuals as *Nemophila breviflora* and *Galium bifolium*.

Tree productivity on this relatively moist site varies widely but is usually high. Basal area ranged from 87 to 283 ft$^2$/acre (19.9 to 65.1 m$^2$/ha), and averaged 183 ft$^2$/acre (42 m$^2$/ha). This consisted almost entirely of aspen. Site index for aspen at 80 years ranged from 45 to 78 ft (13.7 to 23.8 m) and averaged 65 ft (19.9 m). Aspen reproduction within these mature stands varied widely but was generally high, averaging almost 5,600 suckers/acre (13 900/ha), three-fourths of which were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Undergrowth production generally is high and dominated by forbs, many of which are palatable to livestock. Production ranged from 956 to 1,692 lb/acre (1 083 to 1 899 kg/ha) and averaged 1,228 lb/acre (1 378 kg/ha). Over three-fourths of this production consisted of forbs and the remainder was divided between graminoids and shrubs. Of the undergrowth, 85 percent fell into the desirable and intermediate forage suitability classes. The type is considered good summer range for livestock, particularly for sheep, but of only moderate value as wildlife habitat because of relatively low structural diversity.

Figure 5.—The infrequent but broad-ranging *Populus tremuloides/Heracleum lanatum* c.t. is structurally simple but is usually productive. *Heracleum lanatum* is a conspicuous component of the undergrowth. This stand occupies a moist, easterly exposure at 8,000 ft (2 440 m) elevation near Mt. Timpanogos on the Uinta National Forest; 98 percent of the undergrowth production was forbs.

Types similar to the POTR/HELA c.t. occur at least in Wyoming and in Colorado. Youngblood and Mueggler (1981) describe such a type in western Wyoming that is virtually identical. A *P. tremuloides/Heracleum sphondylium* habitat type was described for northwestern Colorado (Hoffman and Alexander 1980, 1983) that is similar to our type. Dorn (1977) indicates that *H. sphondylium* is synonymous with *H. lanatum*.

## *Populus tremuloides/Pteridium aquilinum* Community Type (POTR/PTAQ c.t.)

This infrequent but distinct community type occurred principally on the Wasatch Range in northern Utah, particularly on that portion between Salt Lake City and Heber City. One stand was encountered as far south as the Markagunt Plateau east of Cedar City. The 13 stands sampled within this type generally ranged in elevation between 5,800 and 8,400 ft (1 770 and 2 560 m). The stand in southern Utah was at 9,350 ft (2 850 m). These stands occupied soils of sedimentary as well as granitic origin. They did not appear restricted by either exposure or steepness of slope.

The POTR/PTAQ c.t. is readily identified by the abundance of *Pteridium aquilinum* in the undergrowth and the absence of a pronounced shrub stratum (fig. 6). However, minor amounts of some shrubs, particularly *Symphoricarpos oreophilus* and *Sambucus racemosa*, may be present. Members of the tall forb group are usually associated in the herbaceous layer with the conspicuously dominant *P. aquilinum*. The most frequent of these are *Rudbeckia occidentalis, Agastache urticifolia, Senecio serra*, and *Aster engelmannii*. Occasionally *Lathyrus* spp. may be abundant. Graminoids, especially *Bromus carinatus* and *Elymus glaucus*, are often present in substantial amounts. Conifers are usually absent.

The successional status of this type is uncertain. *Pteridium aquilinum* is a native species sporadically distributed in Utah and elsewhere throughout the West. Where it does occur, however, it is usually a dominant

Figure 6.—The distinctive *Populus tremuloides/Pteridium aquilinum* c.t., though seldom encountered, is widespread in the Intermountain and Rocky Mountain area. *Pteridium aquilinum* overwhelmingly dominates the undergrowth in this stand found in the Big Flat area of the Uinta National Forest west of Heber City.

part of the undergrowth. This suggests that it may be indicative of a specific site situation, and that such stands represent more or less stable conditions or climax community types. On the other hand, *P. aquilinum* is both unpalatable to livestock and reproduces readily by creeping rhizomes. Overgrazing that inhibits the growth of palatable forage species would encourage the growth and reproduction of *P. aquilinum*. Judging from undergrowth composition, this type might also represent a grazing-degraded seral stage of a POTR/SESE climax community type, if the presence of *P. aquilinum* were ignored. In either event, abusive grazing will tend to encourage dominance of *P. aquilinum* and possibly *R. occidentalis* at the expense of such forage species as *A. engelmannii, A. urticifolia, B. carinatus*, and *E. glaucus*.

Tree production within this type is moderate to high. Basal area, 99 percent of which was aspen, ranged from 76 to 224 $ft^2$/acre (17.3 to 51.4 $m^2$/ha) and averaged a moderate 146 $ft^2$/acre (33.6 $m^2$/ha). Aspen site index at 80 years ranged from 47 to 78 ft (14.3 to 23.8 m) and averaged a moderately high 60 ft (18.3 m). Aspen reproduction varied widely but was comparatively high for mature stands. It averaged approximately 7,600 suckers/acre (18 900 ha), of which about half were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Although undergrowth production in this type is generally high, it is of low to moderate value as livestock forage. Production ranged from 1,035 to 2,292 lb/acre (1 162 to 2 572 kg/ha) and averaged 1,570 lb/acre (1 762 kg/ha). Over 90 percent of this was forbs, primarily the unpalatable *P. aquilinum*. Of the total undergrowth, 48 percent was classified within the least desirable forage suitability class. The type also has low to moderate value as wildlife habitat because it lacks structural diversity as well as having a low abundance of palatable species.

Although infrequent, the POTR/PTAQ type appears fairly widespread. Hoffman and Alexander (1980, 1983) identified similar aspen stands with *P. aquilinum* dominating the undergrowth as a distinct habitat type on the Routt and White River National Forests in northwestern Colorado. The main difference in the Colorado communities is the occurrence of substantial amounts of *Carex geyeri* in most stands.

## *Populus tremuloides/Senecio serra* Community Type (POTR/SESE c.t.)

The POTR/SESE community type is one of the most frequently encountered types in northern Utah. We sampled 125 stands to form the data base for this type. Although the type occurs principally on the Bear River and Wasatch Ranges and on the west slope of the Uintas, it can be found at scattered locations throughout the higher elevations as far south as the Abajo Mountains in the southeast and the Markagunt Plateau in southwestern Utah. It is primarily a middle to fairly high elevation type; sampled stands ranged in elevation between 6,000 to 10,300 ft (1 830 and 3 140 m). These stands occurred on all exposures, mostly on gentle to moderately steep slopes, and on relatively deep soils derived from sandstone, limestone, quartzite, and granitic parent materials. Stands were seldom found on volcanic soils.

Vegetation in this common type is structurally simple but compositionally complex. An occasional conifer, usually *Abies lasiocarpa*, may be present with the aspen but in only small amounts. A shrub stratum per se is lacking even though *Symphoricarpos oreophilus* and *Sambucus racemosa* are often present as incidental species. Consequently, the aspen undergrowth consists almost exclusively of a broad assemblage of herbaceous species characterized by a diverse mixture of tall forbs, no one of which is consistently dominant, accompanied by low forbs, graminoids, and annuals (fig. 7). Although *Senecio serra* is used as an epithet representing the tall forb group, it need not be present for a stand to qualify for this community type. Species of tall forbs commonly encountered include *S. serra, Rudbeckia occidentalis,*

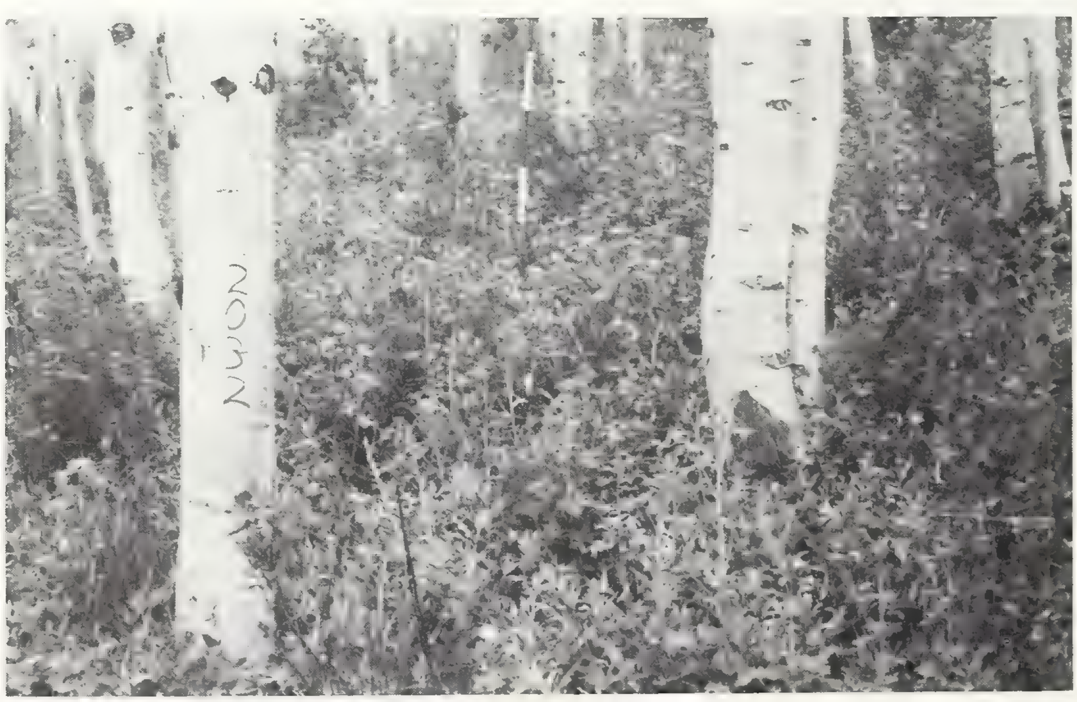

**Figure 7.—The *Populus tremuloides/Senecio serra* c.t. is one of the most common aspen types, especially in northern Utah. This stand occurred at 8,600 ft (2 620 m) elevation in the upper Cottonwood Creek drainage on the Manti-LaSal National Forest northeast of Fairview. The undergrowth typically consists of a diverse and productive mixture of tall forbs, low forbs, and graminoids.**

*Valeriana occidentalis, Mertensia arizonica, Agastache urticifolia, Delphinium occidentale*, and *Polemonium foliosissimum*. Combinations of these occur in varying but usually noticeable amounts. Other common forbs include *Thalictrum fendleri, Stellaria jamesiana, Osmorhiza chilensis, Vicia americana*, and *Lathyrus* spp. Substantial amounts of grasses are usually interspersed among the forbs; most common and abundant of these are *Bromus carinatus, Agropyron trachycaulum*, and *Elymus glaucus*. Pocket gophers frequently churn the relatively deep, loose soil of this type, providing conditions amply suited for the growth of such annuals as *Nemophila breviflora, Polygonum douglasii, Collomia linearis*, and *Galium bifolium*.

POTR/SESE is a major climax aspen community type that is especially prevalent in northern Utah. Occasional stands classified into this type could be considered seral communities within the *A. lasiocarpa/O. chilensis* habitat type (Mauk and Henderson 1984) if *A. lasiocarpa* were able to actively invade and replace the aspen overstory. Prolonged heavy grazing in this type will probably cause a substantial reduction in species diversity. If abusively grazed by sheep, a decrease in the more palatable forbs can be expected with a corresponding increase in *E. glaucus, B. carinatus*, and *R. occidentalis*. Such use by cattle will tend to shift community composition strongly toward *R. occidentalis* and possibly *Lathyrus* spp. In some cases, *S. serra* may also increase substantially under heavy cattle use. Prolonged abusive grazing by either class of livestock would likely eliminate many of the more palatable perennials and favor an increase in annuals (fig. 8).

The potential of the type for wood production appears to be slightly better than the average for all of the aspen community types. We sampled 64 stands within this type for production. Tree basal area ranged from 46 to 302 $ft^2$/acre (10.7 to 69.4 $m^2$/ha) and averaged 152 $ft^2$/acre (35.0 $m^2$/ha). An average 99 percent of this was aspen. Site index at 80 years for aspen ranged widely from 32 to 85 ft (9.8 to 25.9 m), and averaged a moderate 54 ft (16.5 m). Aspen reproduction also varied greatly. Sucker numbers ranged between none to well over 8,100/acre (20 000/ha), and averaged slightly over a moderate 2,500/acre (6 100/ha). Approximately half of these suckers were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Undergrowth production in this extensive type varies greatly but overall appears to be about average for all aspen types. Based on a sample of 59 stands, it ranged from 234 to 2,853 lb/acre (263 to 3 202 kg/ha) and averaged 1,149 lb/acre (1 289 kg/ha). The bulk of this undergrowth, 72 percent, consisted of forbs; graminoids comprised 25 percent, and shrubs 3 percent. Of the vegetation, 79 percent was classified as either desirable or of intermediate forage suitability. The type, therefore, is at least moderately productive livestock range, particularly for sheep. Shrub cover usually is incidental; structural diversity is therefore low even though species diversity may be high. Thus, the type is only of relatively moderate value as wildlife habitat because of the absence of an effective shrub component in the undergrowth.

Not only is the POTR/SESE c.t. common in Utah, aspen communities with similar vegetation structure and characterizing species are widespread elsewhere. The *P. tremuloides/R. occidentalis* community type described for the Caribou and Targhee National Forests in Idaho (Mueggler and Campbell 1982) apparently is a generalized combination of stands that fall within our POTR/SESE c.t. and POTR/HELA c.t. Those stands similar to our POTR/SESE type have many of the same characteristics but lack the *Lathyrus* spp. and *Vicia americana* that are common in the Utah stands. Both the *P. tremuloides/R. occidentalis* and *P. tremuloides/ Ligusticum filicinum* types described by Youngblood and Mueggler (1981) for western Wyoming contain stands similar to our POTR/SESE c.t. except for the lack of *Lathyrus* spp. and *V. americana* in the Wyoming stands and the greatly reduced occurrence of *L. filicinum* in the Utah stands. About half the aspen stands Hoffman and Alexander (1980, 1983) used to characterize the *P. tremuloides/T. fendleri* habitat type in northwestern

**Figure 8.—Prolonged abusive grazing can reduce the productive undergrowth of the *Populus tremuloides/ Senecio serra* c.t. (fig. 7) to an impoverished condition dominated by such annuals as *Nemophila breviflora, Collomia linearis, Polygonum douglasii*, and *Galium biflorum*, with only trace amounts of the former perennial cover. An example is this stand on the Nebo Loop Road, Uinta National Forest.**

Colorado contain the tall forb and grass components similar to our POTR/SESE c.t. Their *P. tremuloides/ T. fendleri* type appears to be primarily a more generalized combination of our POTR/SESE and POTR/CAGE types. Aspen communities similar to the Utah POTR/SESE c.t. have also been noted in northeastern Nevada (Lewis 1975).

## *Populus tremuloides/Carex geyeri* Community Type (POTR/CAGE c.t.)

This is a relatively common community type widely distributed in the higher mountains throughout Utah, with 90 percent of the 49 sampled stands at elevations over 8,000 ft (2 440 m). The type was found on all exposures, on shallow to steep slopes, and on a wide variety of soil parent materials. The type occurred most frequently on soils derived from sandstone, volcanics, and granite.

The vegetation of this type bears considerable resemblance to that of the POTR/SYOR/CAGE community types except for the lesser amounts of the key shrubs. *Symphoricarpos oreophilus* or *Juniperus communis* or both are frequently part of the undergrowth in the POTR/CAGE c.t., but not in such amounts that form a distinct shrub stratum. Vegetation structure, therefore, consists essentially of only two layers: the *Populus tremuloides* dominated overstory and the herbaceous undergrowth (fig. 9). *Abies lasiocarpa* and *Picea engelmannii* occasionally accompany *P. tremuloides* in the tree layer but only as incidental species. *Berberis repens* at times provides considerable ground cover. The undergrowth typically consists of substantial amounts of one or more of the following graminoids: *Carex geyeri, Carex rossii, Stipa occidentalis*, and *Calamagrostis rubescens*. These species are considered more or less ecological equivalents in this classification (see the POTR/SYOR/CAGE c.t. section). *Carex geyeri* and *C. rubescens* are most frequently encountered in northern Utah, whereas *S. occidentalis* and *C. rossii* appear more widely distributed. Frequently *Agropyron trachycaulum* is also abundant. The most common forbs in this community type are *Achillea millefolium, Astragalus miser, Geranium viscosissimum*, and *Taraxacum officinale*. Considerable amounts of *Lathyrus* spp. may also be present in some stands.

We believe that the POTR/CAGE is primarily a climax community type. In those cases where *A. lasiocarpa* appears able to actively invade and replace *P. tremuloides*, the stand might be considered a seral stage within an *A. lasiocarpa/B. repens* habitat type (Mauk and Henderson 1984). Heavy, prolonged grazing of this type will probably shift undergrowth composition toward greater abundance of *A. miser, T. officinale*, and *Poa pratensis* as the less grazing-tolerant forage species are reduced.

Although tree basal area is relatively high in this type, growth rate is only moderate. Tree basal area on the 24 stands sampled for production ranged from 89 to 322 ft$^2$/acre (20.5 to 73.9 m$^2$/ha) and averaged 171 ft$^2$/acre (39.2 m$^2$/ha). Aspen constituted 99 percent of this. Site index of aspen at 80 years ranged from 32 to 77 ft (9.8 to 23.5 m) and averaged a modest 52 ft (15.7 m). Aspen reproduction averaged a moderate 2,200 suckers/acre (5 500/ha) about half of these in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Annual production of undergrowth usually is fairly low. Although it ranged from 78 to 1,289 lb/acre (88 to 1 447 kg/ha) across 23 stands, it averaged a rather meager 665 lb/acre (746 kg/ha). This production was about equally divided between forbs and graminoids, with less than 5 percent in the shrub category. Of the undergrowth, 93 percent was classified in the desirable and intermediate forage suitability classes. The high percentage of graminoids makes this type better suited for cattle than for sheep. Low productivity, however, limits its value as livestock range. The type is not good wildlife habitat because of its lack of diversity in both vegetation structure and species composition.

This relatively common Utah type occurs also in Idaho, Wyoming, and Colorado. Mueggler and Campbell (1982) identified a *P. tremuloides/C. rubescens* c.t. in


Figure 9.—The *Populus tremuloides/Carex geyeri* c.t., widely distributed throughout the higher mountains and plateaus of Utah, has a relatively simple undergrowth dominated by such graminoids as *C. geyeri, Carex rossii,* or *Stipa occidentalis*. Common forbs include *Achillea millifolium, Geranium viscosissimum*, and *Astragalus miser.*

southeastern Idaho that is virtually identical compositionally to our POTR/CAGE c.t. A *P. tremuloides/ C. rubescens* type was also identified for western Wyoming (Youngblood and Mueggler 1981) that resembles the Utah type but has more structural variation. *Calamagrostis rubescens* usually replaces *C. geyeri* as the characterizing graminoid in these more northern locations. In northwestern Colorado, a structurally and compositionally similar type was identified by Hoffman and Alexander (1983) as the *P. tremuloides/C. geyeri* habitat type. Although the *P. tremuloides/C. geyeri* habitat type described by Wirsing and Alexander (1975) for southeastern Wyoming contains the same characterizing graminoids in the herbaceous stratum, it differs structurally from our POTR/CAGE c.t. because of the abundance of the shrub *J. communis*; their type corresponds more closely to our POTR/JUCO/CAGE c.t.

## *Populus tremuloides/Festuca thurberi* Community Type (POTR/FETH c.t.)

This infrequent community type was encountered only in the southern portion of Utah on the Fishlake, Sevier, and Aquarius Plateaus. The 14 sampled stands were at elevations ranging from 8,000 to 9,500 ft (2 440 to 2 900 m), on moderately steep concave or undulating slopes and over a wide variety of exposures. The stands were encountered only on soils derived from volcanic or granitic parent materials.

The vegetation is characterized by an abundance of the tussock *Festuca thurberi* in the undergrowth (fig. 10). The type is differentiated from the POTR/SYOR/FETH c.t. by the lack of a distinct *Symphoricarpos oreophilus*-dominated shrub layer. However, *S. oreophilus* is frequently present but only in minor amounts. The overstory consists of *Populus tremuloides* with an occasional conifer, primarily *Abies lasiocarpa* and *Picea engelmannii*. Usually *Stipa occidentalis* is present; occasionally *Bromus carinatus* is abundant. The most common forbs associated with these grasses are *Taraxacum officinale, Achillea millefolium, Vicia americana*, and *Lathyrus* spp. In some cases, *Lathyrus* spp. appears to dominate the undergrowth.

The POTR/FETH is basically a climax community type. However, many of the stands in this type appear to have undergone considerable grazing pressure in the past, judging from the amount of *T. officinale, Lathyrus* spp., and *Poa pratensis*. Possibly these stands have had appreciably more *S. oreophilus* that may have been reduced to present levels by heavy sheep use. Such stands would be considered seral stages of a climax POTR/SYOR/FETH c.t. Heavy sheep use would support the increase of *A. millefolium, T. officinale*, and *P. pratensis; F. thurberi* probably would not be adversely affected unless such use were extreme. Heavy cattle use would tend to reduce the *F. thurberi* and support an increase in the remaining forbs and *P. pratensis*.

This type is productive for aspen. Basal area of the five stands sampled for production ranged from 134 to 325 ft$^2$/acre (30.8 to 74.6 m$^2$/ha) and averaged a high 199 ft$^2$/acre (45.6 m$^2$/ha). Virtually all of this basal area consisted of aspen. Site index at 80 years for aspen ranged from 53 to 63 ft (16.2 to 19.2 m) and averaged a moderately high 59 ft (17.9 m). Aspen reproduction was generally low, averaging approximately 1,000 suckers/acre (2 500/ha). Two-thirds of these were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Annual production of undergrowth varies widely but is generally moderate. It averaged 1,218 lb/acre (1 367 kg/ha) on the sampled stands but ranged from 448 to 3,492 lb/acre (502 to 3 919 kg/ha). This consisted of 58 percent graminoids and 41 percent forbs. A total of 89 percent was classified as either desirable or as intermediate forage suitability. Considering total productivity and the high proportion of grasses, the type is fairly good livestock range, especially for cattle. Lack of a shrub complex, which contributes to structural diversity, limits the type's value as wildlife habitat.

Aspen communities with *F. thurberi* prominent in the undergrowth have also been reported in Colorado. Langenheim (1962) described stands in the Crested Butte area in west-central Colorado that lacked a promi-

Figure 10.—The *Populus tremuloides/Festuca thurberi* c.t. is an uncommon but distinct type found in southern Utah. This stand in the upper Um Creek drainage on the Fishlake National Forest produced an unusually great amount of undergrowth, 3,492 lb/acre (3 919 kg/ha), of which almost three-fourths was *F. thurberi*.

nent shrub layer. Although the undergrowth was dominated by *Thalictrum fendleri, Ligusticum porteri*, and *V. americana*, those stands contained appreciable amounts of *F. thurberi*.

## *Populus tremuloides/Sitanion hystrix* Community Type (POTR/SIHY c.t.)

The POTR/SIHY c.t. is a fairly uncommon and relatively arid type found primarily in southern Utah. It was usually encountered on the Aquarius and Markagunt Plateaus. One stand was observed on the south slope of the Uinta Mountains north of Roosevelt. The 11 stands sampled in this type were on widely different exposures, shallow to moderately steep slopes, and on soils derived primarily from volcanic, granitic, or sandstone parent materials. These stands were at elevations between 8,000 and 9,500 ft (2 440 and 2 900 m).

Vegetation structure of this type is essentially two-layered: a *Populus tremuloides* overstory with a rather sparse undergrowth composed largely of graminoids. Although *Juniperus communis, Berberis repens*, and *Symphoricarpos oreophilus* may occasionally be present, they are never abundant enough to form a distinct shrub layer. The herbaceous undergrowth is usually dominated by *Sitanion hystrix, Stipa comata*, and *Poa fendleriana*. The most conspicuous forbs are usually *Antennaria microphylla, Lupinus argenteus*, and *Taraxacum officinale*. This type differs from the POTR/JUCO/SIHY c.t. primarily in the lack of a distinct shrub layer of *J. communis* or *Artemisia tridentata* or both, and by the greater abundance of *S. hystrix* and *S. comata*.

This appears to be a relatively stable aspen type restricted to comparatively dry sites. *Pinus ponderosa* may be present occasionally as an accidental species. In stands where *P. ponderosa* is actively invading, and especially if *J. communis* is also present, the stands probably should be placed in the POTR-PIPO/JUCO c.t.

The abundance of *S. hystrix* and *T. officinale* suggests that the undergrowth has been appreciably degraded by prolonged and heavy livestock grazing. Very likely *P. fendleriana, Bromus ciliatus*, and possibly *S. oreophilus* were more abundant in many of these stands prior to the advent of domestic livestock. Continued abusive grazing would favor an even greater abundance of such low-palatability species as *S. hystrix* and *A. microphylla*, and a loss of those species that are more palatable to sheep and cattle.

The type is only moderately productive for trees. Basal area ranged from 94 to 203 ft$^2$/acre (21.5 to 46.6 m$^2$/ha) but averaged only 155 ft$^2$/acre (35.7 m$^2$/ha). Aspen made up 96 percent of this total. Aspen site index at 80 years ranged from 30 to 63 ft (9.1 to 19.2 m) and averaged a moderately low 47 ft (14.3 m). Aspen reproduction was also low with suckers averaging less than 770/acre (1 900/ha), two-thirds of which were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Undergrowth production is generally low and rather evenly divided between forbs and grasses. Annual production ranged from 319 to 823 lb/acre (358 to 923 kg/ha) and averaged only 472 lb/acre (530 kg/ha). Graminoids made up 47 percent of this, 51 percent was forbs, and only 2 percent was in the shrub category. However, 62 percent of the undergrowth was desirable forage and 33 percent was of intermediate suitability. Although the type does not support much undergrowth, it does rate high as livestock forage, especially for cattle. This relatively dry type is rather poor wildlife habitat because the vegetation lacks good structural diversity and produces comparatively little undergrowth.

Aspen communities resembling this type have not been reported outside of Utah.

## *Populus tremuloides/Bromus carinatus* Community Type (POTR/BRCA c.t.)

This seral community type was encountered primarily in northern and central Utah, but one stand was observed in the Abajo Mountains in the southeast corner of the State. The type is somewhat infrequent. We sampled only 14 stands occurring at elevations between 7,400 and 9,400 ft (2 260 and 2 870 m) on usually less than 25-percent slopes and on all exposures. The type occurs primarily on sedimentary soils derived from sandstone and limestone parent materials.

Conifers are seldom present and never abundant in the POTR/BRCA c.t. The undergrowth vegetation is typified by the lack of a shrub layer and the dominance of tall grasses, *Bromus carinatus* or *Elymus glaucus* or both in the herbaceous layer (fig. 11). Shrubs, especially *Symphoricarpos oreophilus*, are often present but never in such amounts to form a distinct stratum. Principal forbs most frequently present are *Thalictrum fendleri, Achillea millefolium, Rudbeckia occidentalis, Vicia americana*, and *Lathyrus* spp. This type is similar to the POTR/SYOR/BRCA c.t., except for the lack of shrubs.

Although the aspen overstory apparently is stable in the POTR/BRCA c.t., the undergrowth is considerably altered by grazing. The type is most likely seral to the POTR/SESE climax community type. Heavy and prolonged sheep use appear to have reduced the abundance of tall forbs and permitted substantial increases in the amount of *B. carinatus, E. glaucus*, and *Agropyron trachycaulum*. The type is similar to the POTR/SYOR/BRCA c.t., except for a lesser amount of *S. oreophilus* and *Geranium viscosissimum*, both of which tend to decrease with heavy sheep use. Thus, it is possible that the POTR/BRCA c.t. may also be a grazing-induced seral stage of the POTR/SYOR/SESE climax community type. Heavy grazing of the POTR/BRCA c.t. by cattle would tend to result in a decrease of *B. carinatus, A. trachycaulum*, and *E. glaucus*, and an increase of *R. occidentalis, Poa pratensis*, and *Taraxacum officinale*.

Tree production in this type appears to be only moderately good. Basal area ranged widely between 39 and 189 ft$^2$/acre (9.0 and 43.4 m$^2$/ha) and averaged a modest 129 ft$^2$/acre (29.6 m$^2$/ha). Virtually all of this was aspen. Site index at 80 years for aspen ranged between 48 and 79 ft (14.6 and 24.1 m) and averaged a moderate 56 ft (17 m). Aspen reproduction was also moderate, averaging less than 1,300 suckers/acre (3 200/ha), about half of which were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Undergrowth production in this grazing-induced type is only moderate. Annual production of dry herbage ranged from 371 to 1,877 lb/acre (417 to 2 106 kg/ha)

Figure 11.—The *Populus tremuloides/Bromus carinatus* c.t. is probably a grazing-induced seral type created by heavy, prolonged sheep grazing of a climax POTR/SESE c.t. The undergrowth in this stand in the upper part of the Seventeen Mile Creek drainage of the Fishlake National Forest is dominated by *B. carinatus* and *Agropyron trachycaulum*.

and averaged 1,219 lb/acre (1 369 kg/ha). The bulk of this was divided rather evenly between grasses (50 percent) and forbs (46 percent); only 4 percent was shrubs. Of the undergrowth, 35 percent was classified as desirable and 60 percent was of intermediate forage suitability. The type, therefore, is moderately productive livestock range, particularly for cattle. Because this type apparently has been altered considerably by heavy grazing, its potential for producing forage is probably greater than its current production. Judging from perceived successional relationships, the proportion of palatable forbs and possibly shrubs was at one time much greater than at present. Wildlife habitat values are comparatively low because of the simplicity of vegetation structure and lack of undergrowth diversity.

This seral type has not been reported elsewhere. But because it is believed to represent a grazing-degraded stage of the POTR/SESE c.t. and possibly the POTR/SYOR/SESE type, which are both present in surrounding States, this seral type likely occurs there as well.

## *Populus tremuloides/Poa pratensis* Community Type (POTR/POPR c.t.)

The POTR/POPR c.t. is a seral type that, although not common, spans the State from the Bear River and Uinta Mountains in the north, to the Markagunt Plateau and LaSal Mountains in the south. We sampled 18 stands to describe this type, ranging in elevation from 7,000 to 9,450 ft (2 130 to 2 880 m) and usually occurring on flats or shallow slopes (less than 25 percent) of northerly or easterly exposures. Soil parent material did not appear restrictive.

The vegetation of this degraded type is relatively simple (fig. 12). It differs from that of the POTR/SYOR/POPR c.t. only in the amount of *Symphoricarpos oreophilus*. Although *S. oreophilus* is usually present in the POTR/POPR c.t., it is never sufficiently abundant to form a distinct shrub layer. The depauperate undergrowth is dominated by *Poa pratensis* or *Taraxacum officinale* or both. Substantial amounts of *Agropyron trachycaulum* are also frequently present. A

Figure 12.—The *Populus tremuloides/Poa pratensis* c.t. is a grazing-induced type dominated by such grazing-resistant species as *P. pratensis, Taraxacum officinale, Achillea millifolium,* and *Trifolium longipes*, as in this stand on Webster Flat southeast of Cedar City. Although not common, the type is encountered occasionally on flats or shallow slopes throughout Utah.

limited variety of other species such as *Berberis repens, Rosa woodsii, Osmorhiza chilensis, Lupinus argenteus, Astragalus miser*, and *Vicia americana* may be irregularly present in lesser amounts.

A variety of conifers may occur in this type as incidentals, but the aspen overstory appears to be stable. The undergrowth, however, reflects a long history of overgrazing of what probably was once either a POTR/CAGE or a POTR/SYOR/CAGE climax community type. The dominant *P. pratensis* and *T. officinale* are palatable to both cattle and sheep. Their growth form enables them to withstand grazing and increase in amount as competition from the more grazing-sensitive species is reduced. Continued heavy grazing probably will not further alter the undergrowth appreciably, at least until the aspen overstory begins to break up with old age and browsing suppresses aspen sucker regeneration. If this should happen, the aspen stand will eventually be lost.

This type is generally only moderately productive for growth of trees. Tree basal area ranged from 71 to 193 $ft^2$/acre (16.3 to 44.3 $m^2$/ha) and averaged 126 $ft^2$/acre (28.9 $m^2$/ha). All but 1 percent of this was aspen. Site index at 80 years ranged from 30 to 70 ft (9.1 to 21.3 m) and averaged a moderate 53 ft (16.1 m). Aspen regeneration was a moderate 1,900 suckers/acre (4 700/ha). Slightly more than half of these were in the 1- to 4.6-ft (0.3- to 1.4-m) height class.

Forage production on this grazing-altered type generally appears to be considerably less than the potential for the site. Not only has heavy grazing changed undergrowth composition but may have reduced its total biomass as well. Undergrowth production varied from 303 to 1,287 lb/acre (340 to 1 445 kg/ha) and averaged a low to moderate 780 lb/acre (876 kg/ha). This was composed of 58 percent forbs, 37 percent graminoids, and 5 percent shrubs. Only 29 percent of the vegetation was desirable forage; 69 percent was of intermediate forage suitability. This contrasts markedly with 57 percent in the desirable category for the successionally related POTR/CAGE c.t., and 51 percent desirable in the related POTR/SYOR/CAGE c.t. Therefore, the POTR/POPR type should be considered relatively poor livestock range that has considerable potential for improvement. The simplicity of vegetation structure and species composition detracts considerably from the value of this type as wildlife habitat. It and the POTR/SIHY c.t. are probably among the poorest of the aspen types for this use.

A similar *P. tremuloides/P. pratensis* seral type has been identified in southeastern Idaho (Mueggler and Campbell 1982). Although not reported elsewhere, similar communities likely occur in Wyoming and Colorado. The type is probably a grazing-induced seral stage of the POTR/CAGE and POTR/SYOR/CAGE types, which apparently do occur in these states (Hoffman and Alexander 1983).

## *Populus tremuloides-Abies lasiocarpa/ Vaccinium caespitosum* Community Type (POTR-ABLA/VACA c.t.)

This infrequent community type is primarily restricted to the Uinta Mountains. We sampled only four stands at approximately 9,000 ft (2 740 m) elevation on moderately steep slopes with concave or undulating topography. They occupied soils principally derived from quartzite parent materials.

The POTR-ABLA/VACA c.t. is a seral type that is rapidly succeeding to conifers. Both *Abies lasiocarpa* and *Pinus contorta* are replacing *Populus tremuloides* in the overstory. A low shrub layer consisting primarily of either *Vaccinium caespitosum* or *Vaccinium scoparium* dominates the undergrowth. Herbaceous cover is generally sparse, with *Arnica latifolia* usually being most abundant.

Apparently, the type is a seral stage within the *A. lasiocarpa/V. caespitosum* or possibly the *A. lasiocarpa/V. scoparium* habitat types (Mauk and Henderson 1984). *Populus tremuloides* is intolerant of shade and is subject to rapid replacement by *A. lasiocarpa*, barring fire or other disturbance that would retard the conifers. As the conifer cover increases, the undergrowth will become even more depauperate. An aspen stand can only be maintained here by periodic clearcutting, burning, or other disturbance that kills the conifers and stimulates aspen suckering.

Neither tree nor undergrowth productivity were sampled in this type. However, tree basal area, primarily conifers, averaged 170 $ft^2$/acre (39 $m^2$/ha) in the successionally related *Abies lasiocarpa/Vaccinium caespitosum* habitat type, and 178 $ft^2$/acre (41 $m^2$/ha) in the possibly related *A. lasiocarpa/V. scoparium* habitat type (Mauk and Henderson 1984).

Annual undergrowth production within this seral type depends, to a great extent, upon the amount of conifers present. Typically, as the proportion of conifers increases, undergrowth decreases. The somewhat similar POTR-ABLA/CAGE c.t., with an average 20 percent conifers in the overstory, produced approximately 270 lb/acre (300 kg/ha) undergrowth. Production within the POTR-ABLA/VACA c.t. probably averages about this amount. Judging from species composition of the undergrowth, approximately a third of this is in the desirable and two-thirds is in the intermediate forage suitability class. Thus, the type is poor livestock range and probably not more than moderate wildlife habitat.

This seral type has not been specifically identified as occurring outside of Utah. However, it or a similar seral type may be present at least in northwestern Colorado. Hoffman and Alexander (1980, 1983) indicate that *P. tremuloides* is a seral species in the *A. lasiocarpa/ V. scoparium* habitat type found there.

## *Populus tremuloides-Abies lasiocarpa/ Amelanchier alnifolia* Community Type (POTR-ABLA/AMAL c.t.)

This minor seral community type was encountered principally on the Bear River and Wasatch Ranges in northern Utah. Two stands were observed in the Abajo Mountains of southeastern Utah. The type occurred at the lower edge of the *Abies lasiocarpa* zone. The northern Utah stands were at elevations between 6,300 and 7,800 ft (1 920 and 2 380 m), whereas those in the Abajo Mountains were at 8,600 ft (2 620 m). The type occurred most frequently on slopes with northerly and easterly exposures and occupied soils derived from a wide variety of parent materials.

The POTR-ABLA/AMAL c.t. contains a high degree of both structural and species diversity. The vegetation is comprised of four more or less distinct layers. The tree overstory is dominated by *Populus tremuloides* but has a substantial amount of *A. lasiocarpa* that may also be accompanied by other conifers. The tall shrub layer in the undergrowth is typified by the presence of *Amelanchier alnifolia, Prunus virginiana*, or *Acer grandidentatum.* A pronounced low shrub layer exists that usually has *Symphoricarpos oreophilus* as its most abundant constituent. Other frequently abundant shrubs include *Pachistima myrsinites, Berberis repens*, and *Rosa woodsii.* The herbaceous layer usually contains a rich mixture of graminoids and forbs. *Thalictrum fendleri* is usually among the most abundant and may be accompanied by such species as *Aster engelmannii, Senecio serra, Geranium viscosissimum, Osmorhiza chilensis, Elymus glaucus*, and *Agropyron trachycaulum.*

The type obviously represents a seral stage within the *A. lasiocarpa* coniferous forest series, probably within the *A. lasiocarpa/Acer glabrum* or *A. lasiocarpa/ O. chilensis* habitat types (Mauk and Henderson 1984). The natural process of succession in this type will lead to overstory dominance by *A. lasiocarpa.* As conifers become more prevalent, the shrubby and herbaceous undergrowth tends to become less abundant, less diverse, and shift in composition toward the more shade-tolerant species. Heavy grazing in this type tends to suppress the *S. oreophilus* and *A. engelmannii* and to favor *P. myrsinites* and *B. repens.* If grazed by cattle, composition would additionally tend to shift away from the grasses *A. trachycaulum* and *E. glaucus* and toward a greater abundance of *T. fendleri* and *O. chilensis.* Heavy sheep grazing, on the other hand, would tend to suppress *T. fendleri* and *O. chilensis* and favor the grasses.

Productivity for trees in this seral aspen type appears relatively moderate. Tree basal area ranged from 53 to 288 ft$^2$/acre (12.1 to 66.2 m$^2$/ha) and averaged 150 ft$^2$/acre (34.4 m$^2$/ha). An average 15 percent of this basal area consisted of conifers and the remainder was aspen. Site index for aspen at 80 years ranged from 47 to 66 ft (14.3 to 20.1 m) and averaged 54 ft (16.5 m). Aspen reproduction averaged approximately 1,800 suckers/acre (4 500/ha), about two-thirds of which were in the large 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer reproduction, 95 percent of which was *A. lasiocarpa*, averaged approximately 890 stems/acre (2 200/ha). About 20 percent of these were in the large size class.

The undergrowth is fairly productive for a seral type and contains a high proportion of shrubs. Annual growth ranged from 578 to 1,986 lb/acre (649 to 2 229 kg/ha) and averaged a moderate 1,256 lb/acre (1 410 kg/ha). An average 53 percent of this was shrubs, 36 percent forbs, and only 11 percent graminoids. A high 62 percent of the undergrowth is of desirable forage suitability. The type is good livestock range, particularly for sheep, if succession has not progressed to the point where conifers are appreciably suppressing the production of shrubs and herbs. The type is considered excellent wildlife habitat because of the great amount of structural diversity: an overstory consisting of both aspen and conifers, a tall shrub layer, a low shrub layer, and an herb layer of forbs and grasses.

This seral type has not been identified elsewhere. However, it is believed to be a seral stage in the *A. lasiocarpa/ O. chilensis* habitat type in Utah, and Steele and others (1983) list *P. tremuloides* as a seral species in the *A. lasiocarpa/O. chilensis* habitat type in eastern Idaho and western Wyoming. The seral type was not recognized per se in that area (Mueggler and Campbell 1982; Youngblood and Mueggler 1981).

## *Populus tremuloides-Abies lasiocarpa/ Symphoricarpos oreophilus/ Senecio serra* Community Type (POTR-ABLA/SYOR/SESE c.t.)

The POTR-ABLA/SYOR/SESE c.t. is fairly common in northern Utah and most prominent on the Bear River and Wasatch Ranges and on the west slope of the Uintas. Elsewhere, it is widely scattered, extending southward to occasional occurrences on the high plateaus and mountain ranges in southern Utah. We sampled 48 stands of this type at elevations ranging from 6,800 to 8,900 ft (2 070 to 2 710 m) in northern Utah and between 8,500 and 9,400 ft (2 590 and 2 870 m) in southern Utah. The type occupies all exposures and slopes of varying steepness but usually on concave or undulating topography. The type occurred most frequently on soils derived from sandstone and limestone parent materials but was not encountered on volcanic soils.

The type is characterized by the presence and projected increasing abundance of *Abies lasiocarpa* in the tree layer, the absence of a distinct tall shrub layer, a low shrub layer dominated by *Symphoricarpos oreophilus* or *Rubus parviflorus*, and the prominence of tall forbs or tall grass species in the herbaceous layer. This herb layer usually consists of a rich composite of forbs and grasses. Members of the tall forb group are conspicuous. Although the particular combination of tall forbs present may vary, the most constant are *Senecio serra, Rudbeckia occidentalis, Agastache urticifolia, Valeriana occidentalis, Aster engelmannii, Mertensia arizonica*, and *Delphinium occidentale.* Other forbs commonly present include *Thalictrum fendleri, Hackelia floribunda, Geranium viscosissimum, Osmorhiza chilensis*, and *Vicia americana.* The tall grasses *Bromus carinatus,*

*Elymus glaucus*, and *Agropyron trachycaulum* are also frequently present.

The POTR-ABLA/SYOR/SESE c.t. represents a seral stage in the *A. lasiocarpa* coniferous forest climax series, probably within the *A. lasiocarpa/O. chilensis* habitat type (Mauk and Henderson 1984). As *A. lasiocarpa* gains overstory dominance, shading intensity increases, *Populus tremuloides* degenerates and fails to sucker, and the highly productive and diverse undergrowth changes to a less complex and productive assemblage of species. The tall forbs, grasses, and shrubs will decrease in importance, whereas *O. chilensis, T. fendleri*, and *Stellaria jamesiana* will become increasingly prominent.

Heavy grazing in this type usually will lead to a decrease of many of the tall forbs, especially *A. urticifolia, A. engelmannii*, and *S. serra*, and an increase in *R. occidentalis, H. floribunda, S. jamesiana, Achillea millefolium*, and possibly *Lathyrus* spp. Prolonged abusive grazing can lead to a substantial increase in *Poa pratensis* and *Taraxacum officinale*, or even replacement of perennial species with annuals such as *Nemophila breviflora, Polygonum douglasii*, and *Collomia linearis*.

Tree production on these sites is slightly better than average. Basal area ranged from 74 to 249 $ft^2$/acre (17.0 to 57.3 $m^2$/ha) and averaged a high-moderate 165 $ft^2$/acre (38 $m^2$/ha). Conifers made up 13 percent of this, mostly *A. lasiocarpa*. Aspen site index at 80 years ranged from 33 to 74 ft (10.1 to 22.6 m) and averaged a moderate 54 ft (16.6 m). Aspen regeneration was relatively low in these seral stands, averaging slightly over 800 suckers/acre (2 000/ha), of which about half were in the 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer reproduction averaged approximately 240 stems/acre (600/ha), and 80 percent of this was *A. lasiocarpa*. Slightly less than half were in the large reproduction size class.

Undergrowth, though highly variable, is moderately abundant. Annual production for 13 sampled stands ranged between 202 and 2,121 lb/acre (227 and 2 380 kg/ha) and averaged 1,004 lb/acre (1 127 kg/ha). Shrubs were 23 percent and graminoids 18 percent of this, whereas forbs dominated at 59 percent. The vegetation appeared well suited to livestock, with 54 percent in the desirable forage category. The type consequently is fairly good range for livestock, especially in early successional stages before conifers begin to appreciably reduce undergrowth production. The type is also considered good habitat for wildlife because of the relatively high level of vegetation diversity.

The *P. tremuloides-A. lasiocarpa/S. oreophilus* type described by Mueggler and Campbell (1982) for eastern Idaho contains stands similar to this type. Steele and others (1983) indicate that *P. tremuloides* is a major seral species in the *A. lasiocarpa/O. chilensis* habitat type in eastern Idaho and western Wyoming. Because the POTR-ABLA/SYOR/SESE c.t. is believed to be a seral stage in the *A. lasiocarpa/O. chilensis* habitat type in Utah, it is probably farther north as well.

## *Populus tremuloides-Abies lasiocarpa/ Symphoricarpos oreophilus/Carex geyeri* Community Type (POTR-ABLA/ SYOR/CAGE c.t.)

This infrequent but widespread seral community type was encountered from the Bear River Range in the north to the Aquarius Plateau in the south. Of the 14 sampled stands, we encountered five in the LaSal Mountains. Sampled stands occurred at elevations ranging from 7,500 ft (2 290 m) in northern Utah to 9,600 ft (2 930 m) in the south. These stands were most frequently on shallow slopes of less than 25-percent steepness. They did not appear restricted by either slope exposure or soil parent material.

The vegetation of the POTR-ABLA/SYOR/CAGE c.t. consists of three distinct structural layers: a tree layer of mixed *Populus tremuloides* and conifers, a low shrub layer dominated by *Symphoricarpos oreophilus*, and an herbaceous layer with a high proportion of graminoids. Although *Abies lasiocarpa* is the most common conifer invading the aspen community, *Picea engelmannii* and *Pseudotsuga menziesii* may also be conspicuous. The undergrowth composition of this type is fairly similar to that of the POTR/SYOR/CAGE c.t. The low shrub layer is consistently dominated by *S. oreophilus*, but *Berberis repens* and *Rosa woodsii* may also be prominent in this stratum. The herbaceous layer is usually dominated by grasses and sedges. *Carex geyeri* is the most constant and abundant of these, but *Stipa occidentalis* or *Carex rossii* may occasionally replace *C. geyeri* as the dominant graminoid. The forbs most common to this type are *Thalictrum fendleri* and *Achillea millefolium*. At times, *Lathyrus* spp., *Lupinus argenteus*, or *Astragalus miser* are abundant.

This is a seral community type within the *A. lasiocarpa* coniferous forest series. Most likely it represents a seral stage within either the *A. lasiocarpa/ B. repens* or *A. lasiocarpa/C. geyeri* habitat types (Mauk and Henderson 1984; Youngblood and Mauk 1985). As the aspen overstory is gradually replaced by conifers during the natural course of succession, the abundance of undergrowth vegetation will tend to decrease. Heavy livestock grazing in this type will probably lead to increased abundance of *A. miser, Taraxacum officinale*, and *Poa pratensis* at the expense of those species less able to withstand the effects of heavy use. In some stands a large amount of *Lathyrus* spp. or *Lupinus* spp. may result from heavy cattle grazing.

Tree productivity within the type is low. Basal area ranged from 67 to 144 $ft^2$/acre (15.5 to 33.0 $m^2$/ha) and averaged only 109 $ft^2$/acre (25 $m^2$/ha). Of this basal area, 17 percent was conifers and the remainder was aspen. Site index at 80 years for aspen was also low, ranging from 30 to 45 ft (9.1 to 13.7 m) and averaging only 38 ft (11.5 m). Aspen reproduction averaged a low 890 suckers/acre (2 200/ha), 75 percent of which were in the large 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer regeneration averaged slightly over 120 stems/acre (300/ha), of which 93 percent were *A. lasiocarpa* and less than 20 percent of these were in the large size class.

The undergrowth generally is no more than moderately productive. It ranged from 437 to 1,079 lb/acre (491 to 1 210 kg/ha) and averaged a low to moderate 777 lb/acre (872 kg/ha). An average 26 percent of this was shrubs, 58 percent was forbs, and 16 percent was graminoids. A relatively high proportion of this vegetation, 55 percent, was desirable forage. Less than 10 percent fell into the least desirable category. This seral type, therefore, is moderately productive livestock range in the earlier stages of succession to conifer dominance. It is only moderately desirable wildlife habitat because of the somewhat limited amount of vegetation diversity.

Although this seral community type has not been specifically named as occurring elsewhere, it probably can be found in adjacent States. The type is considered a seral stage in the development of climax *A. lasiocarpa/B. repens* and *A. lasiocarpa/C. geyeri* climax forests of Utah that also occur in Idaho, Wyoming, and Colorado. Steele and others (1983) list *P. tremuloides* as a major seral tree in the *A. lasiocarpa/B. repens* habitat type of eastern Idaho and western Wyoming. Hoffman and Alexander (1980, 1983) indicate that *P. tremuloides* is a major seral tree in the *A. lasiocarpa/C. geyeri* habitat type of northwestern Colorado.

## *Populus tremuloides-Abies lasiocarpa/ Juniperus communis* Community Type (POTR-ABLA/JUCO c.t.)

The POTR-ABLA/JUCO c.t. appears restricted in northern Utah to the Uinta Mountains but is much more widespread farther south where it was encountered on the Fishlake, Paunsagunt, and Markagunt Plateaus and in the Tushar Mountains. We sampled 34 stands in this type that generally occurred in the higher mountains at elevations exceeding 8,000 ft (2 440 m). The type otherwise does not appear restricted by either slope exposure or soil parent material.

The vegetation of this type is characterized by the presence of *Abies lasiocarpa* or *Picea engelmannii* along with *Populus tremuloides* in the overstory or as understory reproduction, the absence of a distinct tall shrub layer, and a low shrub layer dominated by *Juniperus communis*. Other conifers frequently present in lesser amounts include *Pseudotsuga menziesii* and *Pinus flexilis*. No single species characterizes the herbaceous undergrowth, which is generally a mixture of various graminoids and forbs. The most common graminoids found here are *Carex rossii, Stipa occidentalis, Bromus anomalus, Bromus ciliatus*, and *Agropyron trachycaulum*. Commonly encountered forbs include *Achillea millefolium, Fragaria vesca, Astragalus miser*, and *Thalictrum fendleri*.

The type obviously represents a seral stage within the *A. lasiocarpa* forest series, probably in either the *A. lasiocarpa/J. communis* or *A. lasiocarpa/Berberis repens* habitat types (Mauk and Henderson 1984; Youngblood and Mauk 1985), judging from species similarities with these habitat types. As with other such aspen communities that are seral to coniferous forests, dominance by *P. tremuloides* can only be maintained by such extreme disturbance as burning, clearcutting, or selective removal of the conifers that would set back the successional processes. Heavy livestock grazing within this type would tend to change the herbaceous composition to favor *A. miser, F. vesca, Taraxacum officinale*, and *Poa pratensis*. The abundance of shrubby *J. communis* undergrowth would likely increase as well.

Tree productivity within this type is at least moderately good. Basal area on the 12 stands sampled for productivity ranged from 98 to 263 $ft^2$/acre (22.5 to 60.4 $m^2$/ha) and averaged 166 $ft^2$/acre (38.1 $m^2$/ha). Only 10 percent of this was conifers and the rest was aspen. Site index for aspen at 80 years ranged from 32 to 71 ft (9.8 to 21.6 m) and averaged a moderate 52 ft (15.7 m). Aspen reproduction averaged a low 730 suckers/acre (1 800/ha), two-thirds of which were in the 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer reproduction averaged slightly less than 325 stems/acre (800/ha), of which three-fourths were *A. lasiocarpa*, and a third of which were in the large reproduction size class.

Undergrowth production appears to be generally low, ranging between 78 and 1,139 lb/acre (88 and 1 278 kg/ha) and averaging a low 374 lb/acre (420 kg/ha). This was about equally distributed among shrubs, forbs, and graminoids. The undergrowth is considered moderately suitable for livestock with 45 percent of the vegetation in the desirable category. However, generally low production limits the value of this type as livestock range. The type is also of only moderate value as wildlife habitat because neither vegetation structure nor plant species diversity are great.

No one has reported this seral community type to occur outside of Utah.

## *Populus tremuloides-Abies lasiocarpa/ Senecio serra* Community Type (POTR-ABLA/SESE c.t.)

This is one of the more common seral community types found throughout the higher mountains of Utah. It is most frequently encountered in northern Utah along the Bear River and Wasatch Ranges and along the west slope of the Uinta Mountains. Of all sampled stands, 8 percent occurred in this community type. Although the type was encountered at elevations as low as 6,400 ft (1 950 m), over two-thirds of the stands were found at elevations between 8,000 and 10,000 ft (2 440 and 3 050 m). The type occupied a wide variety of slopes, exposures, and soils derived from different parent materials.

Vegetation of the POTR-ABLA/SESE c.t. is similar to that of the POTR/SESE type, except for the prominence of conifers in the former. Both types are structurally simple with only a tree overstory and a predominantly herbaceous undergrowth. Shrubs, especially *Symphoricarpos oreophilus*, may occasionally be present but never in sufficient abundance to form a distinct layer. In addition to the paucity of shrubs, the undergrowth is characterized by the conspicuous presence of one or more members of the tall forb complex, usually either *Rudbeckia occidentalis, Senecio serra, Aster engelmannii, Mertensia arizonica*, or *Valeriana occidentalis*. Tall grasses that are in abundance are

Figure 13.—The *Populus tremuloides-Abies lasiocarpa/Senecio serra* c.t. is a seral aspen type common throughout the higher mountains of Utah. The aspen will eventually be replaced by *A. lasiocarpa*. The undergrowth of this stand, on a north exposure in Logan Canyon, Wasatch-Cache National Forest, consists of a mixture of tall and low forbs and graminoids in addition to the conifer reproduction.

*Bromus carinatus, Elymus glaucus*, or both (fig. 13). Other forbs often conspicuous in this type are *Thalictrum fendleri, Osmorhiza chilensis, Achillea millefolium*, and *Lathyrus* spp.

The aspen overstory in this seral type will eventually be replaced by *A. lasiocarpa* during the natural course of succession. The type is most likely a seral stage in the northern Utah *A. lasiocarpa/O. chilensis* habitat type (Mauk and Henderson 1984) and also probably in the central and southern Utah *A. lasiocarpa/Aconitum columbianum* habitat type (Youngblood and Mauk 1985). As *A. lasiocarpa* gains increasing prominence and *P. tremuloides* decreases in the tree overstory, increased shading will appreciably alter undergrowth production and composition. The tall forb and grass complex will tend to decline whereas such low forbs as *T. fendleri* and *O. chilensis* will gain importance as undergrowth. An aspen-dominated community can be maintained on these sites only if the conifers are removed, usually by such drastic means as burning or clearcutting. When this occurs, *P. tremuloides* rapidly suckers, usually profusely, from the remnant root system, whereas the conifers can only reestablish from seed. Rapidity of aspen replacement by conifers depends to a great extent on the availability of a conifer seed source. Replacement might take place in less than 100 years if abundant conifer seedlings become established from residual seed immediately following the disturbance. In other cases, aspen replacement may not occur for several hundred years if conifer establishment depends upon gradual invasion from outside the stand.

Heavy sheep grazing in this type usually leads to a decrease of many of the palatable tall forbs and an increase in the abundance of the grasses *B. carinatus, E. glaucus*, and *Agropyron trachycaulum*. Under heavy cattle use, the grasses and such palatable forbs as *A. engelmannii, S. serra*, and *M. arizonica* tend to decrease and species such as *R. occidentalis, T. fendleri, A. millefolium*, and *Lathyrus* spp. become more prominent. If consistently grazed only in the latter part of the growing season, *S. serra* and *M. arizonica* may increase substantially. Prolonged abusive grazing could lead to undergrowth dominated by *Taraxacum officinale* and *Poa pratensis*, or eventually replacement of perennial herbs by such annuals as *Nemophila breviflora, Collomia linearis*, and *Galium bifolium*.

Productivity of this type for trees is at least moderately high. Basal area on 49 stands sampled for production ranged from 89 to 351 $ft^2$/acre (20.4 to 80.6 $m^2$/ha) and averaged from 177 $ft^2$/acre (40.7 $m^2$/ha). An average 23 percent of this basal area was conifers, primarily *A. lasiocarpa*, and the remainder was aspen. Site index for aspen at 80 years ranged from 33 to 74 ft (10.1 to 22.6 m) and averaged a moderate 52 ft (15.8 m). Aspen reproduction averaged approximately 1,300 suckers/acre (3 300/ha). Half of these were in the large 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer reproduction averaged a little over 890 stems/acre (2 200/ha), of which 96 percent was *A. lasiocarpa*. About a third of the stems were in the large size class.

Production of undergrowth in this seral type is greatly reduced as conifers increase in abundance. Undergrowth in the intensively sampled stands ranged widely from 69 to 2,289 lb/acre (78 to 2 568 kg/ha) and averaged only 767 lb/acre (861 kg/ha). An average 69 percent of this was forbs, 28 percent graminoids, and only 3 percent shrubs. An abundant 55 percent of the undergrowth consisted of desirable forage. Only 11 percent was in the least desirable category. The type, therefore, appears to be fairly good livestock range during that time prior to when conifer competition begins to seriously reduce production of the herbaceous undergrowth. Harper (1973) observed that when conifers increased to approximately 20 $ft^2$/acre (4.6 $m^2$/ha) in an aspen stand, undergrowth production was cut in half. Therefore, by the time conifer invasion accounts for 10 percent of the tree basal area, undergrowth production is probably being reduced appreciably. The mixture of conifers and aspen contributes to vegetation diversity, but the lack of a shrub stratum detracts from the type's value as wildlife

habitat. Early successional stages are of intermediate value to wildlife. This value decreases as succession proceeds to conifer dominance.

Although not identified by the same name, communities similar to this seral type can also be found in Idaho and adjacent Wyoming. Some of the stands used to describe the *P. tremuloides-A. lasiocarpa/Thalictrum fendleri* type in southeastern Idaho (Mueggler and Campbell 1982) resemble those in our Utah type, except for fewer tall forbs. In Utah, the type is regarded as a successional stage within the *A. lasiocarpa/Osmorhiza chilensis* habitat type. Steele and others (1983) show *P. tremuloides* as a major seral tree in this habitat type in eastern Idaho and western Wyoming.

## *Populus tremuloides-Abies lasiocarpa/ Carex geyeri* Community Type (POTR-ABLA/CAGE c.t.)

This community type is fairly common on the high plateaus and mountains of central and southern Utah, although it is found occasionally in northern Utah, principally in the Uinta Mountains. It is a relatively high elevation type. Over 80 percent of the 77 stands sampled were at elevations over 9,000 ft (2 740 m). These stands most frequently occupied rather gentle slopes, and exposures of the slopes did not appear important. Over three-fourths of the stands occurred on soils derived from either volcanic or granitic parent material.

The conspicuous presence of *Abies lasiocarpa* in the tree stratum clearly reflects this type's successional status. *Picea engelmannii* is also frequently present in the tree layer. The undergrowth is characterized by the absence of a distinct shrub layer and the lack of minimal representation by the tall forb and tall grass group of species. The shrubs *Juniperus communis, Berberis repens*, and *Symphoricarpos oreophilus* occasionally may be present but are never abundant. Consequently the undergrowth consists primarily of low herbaceous growth. This usually is composed of such graminoids as *Carex rossii, Stipa occidentalis*, and *Carex geyeri*, and such forbs as *Fragaria vesca, Astragalus miser, Achillea millefolium*, and *Trifolium longipes*. Even though *C. geyeri* has low constancy, it is used in the type name to reflect this particular herbaceous complex for nomenclature consistency. This undergrowth is similar to that in the POTR/CAGE c.t. except for the constancy differences between *C. geyeri* and *C. rossii*, which are considered approximate ecological equivalents (see the POTR/SYOR/CAGE c.t. section). *Carex geyeri* is encountered most frequently in northern Utah, whereas the POTR-ABLA/CAGE type occurs most frequently in central and southern Utah.

The POTR-ABLA/CAGE c.t. is a seral stage within the *A. lasiocarpa* forest series (fig. 14), probably within the central and southern Utah *A. lasiocarpa/C. rossii* habitat type (Youngblood and Mauk 1985), judging from undergrowth similarities. The related habitat type for stands in northern Utah is uncertain.

Heavy grazing within the type leads to further simplification of what is basically rather species-poor undergrowth composition. Grazing tends to favor the dominance of such grazing-resistant species as *A. miser, F. vesca*, and *T. longipes*.

This is a good type for the production of trees and a poor type for the production of undergrowth. Tree growth was measured on 36 stands within the type. Basal area ranged from 93 to 320 ft$^2$/acre (21.3 to 73.4 m$^2$/ha) and averaged 199 ft$^2$/acre (45.6 m$^2$/ha). This was the highest average basal area for any of the community types we encountered. Conifers constituted 20 percent of the basal area. Aspen site index at 80 years ranged from 25 to 64 ft (7.6 to 19.5 m) and averaged a modest 48 ft (14.8 m). Aspen reproduction in these stands averaged a moderate 1,300 suckers/acre (3 300/ha), of which about a fourth were in the large 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer seedlings, 90 percent of which were *A. lasiocarpa*, averaged approximately 1,400 stems/acre (3 400/ha). About half of these were in the large size class.

Production of undergrowth on 31 stands averaged a low 271 lb/acre (304 kg/ha). Almost two-thirds of this

**Figure 14.—*The Populus tremuloides-Abies lasiocarpa/Carex geyeri* c.t., common on the high plateaus of central and southern Utah, is a seral aspen type successional to *A. lasiocarpa* or *Picea engelmannii* forests, or both. Herbaceous undergrowth is usually sparse and consists of such species as *Carex rossii, Astragalus miser, Fragaria vesca*, and *Trifolium longipes*, as in this stand on the Aquarius Plateau, Dixie National Forest.**

consisted of forbs and a third was graminoids. About half the undergrowth was considered to be in the desirable livestock forage category. The undergrowth provides poor livestock range primarily because of generally low productivity. Wildlife habitat values are usually low because the vegetation lacks diversity in both species composition and community structure.

This seral type has not been specifically identified as occurring outside of Utah. However, similar seral communities probably can be found at least in northwestern Colorado. Hoffman and Alexander (1980, 1983) identified an *A. lasiocarpa/C. geyeri* habitat type on the Routt and White River National Forests that has *P. tremuloides* as a major seral tree.

## *Populus tremuloides-Abies concolor/ Symphoricarpos oreophilus* Community Type (POTR-ABCO/SYOR c.t.)

The POTR-ABCO/SYOR c.t., an intermediate elevation type, is widely scattered through central and southern Utah. It was most frequently encountered on the Wasatch Plateau and in the San Pitch Mountains. The 27 stands sampled in this type occurred at elevations ranging from 7,200 to 8,900 ft (2 190 to 2 710 m) and primarily on soils derived from sedimentary parent materials, usually sandstone.

This is one of two aspen-dominated types recognized as successional to an *Abies concolor* climax forest. Being the more moist of the two types, the undergrowth is characterized by an abundance of *Symphoricarpos oreophilus* in a distinct low shrub stratum and the conspicuous presence of members of the tall forb and tall grass groups in the herbaceous layer. The tree overstory contains substantial quantities of *A. concolor*, or occasionally *Picea pungens*. Frequently *Berberis repens* and *Rosa woodsii* are conspicuous shrub associates. No single species characterizes the herbaceous stratum. Instead, various combinations of *Aster engelmannii, Rudbeckia occidentalis, Agastache urticifolia, Mertensia arizonica, Senecio serra, Bromus carinatus, Elymus glaucus*, and *Agropyron trachycaulum* predominate. In addition, *Lathyrus* spp., *Osmorhiza chilensis*, and *Thalictrum fendleri* are frequent associates.

Given time and freedom from disturbance, stands within this community type will eventually succeed to *A. concolor* dominance. Undergrowth species' similarities suggest that the type most likely is a seral stage within *A. concolor/B. repens* or possibly *A. concolor/ O. chilensis* habitat types (Mauk and Henderson 1984; Youngblood and Mauk 1985). As *A. concolor* or *P. pungens* densities increase, and *Populus tremuloides* cover diminish, undergrowth production of tall herbs will give way to the more shade-tolerant *O. chilensis, T. fendleri*, and *B. repens*.

Under heavy cattle grazing, an increase in *R. occidentalis* and possibly *Lathyrus* spp. can be expected at the expense of the more palatable tall forbs and grasses. Heavy sheep use is likely to suppress *S. oreophilus* as well as the palatable tall forbs. Prolonged abusive grazing could lead to substantial increases in the abundance of the grazing-tolerant *Taraxacum officinale* and *Poa pratensis*.

The type apparently is able to support substantial tree basal area but at a rather low rate of growth. Stands sampled for productivity ranged in basal area from 106 to 215 $ft^2$/acre (24.2 to 49.3 $m^2$/ha) and averaged a high 177 $ft^2$/acre (40.7 $m^2$/ha). Conifers were 30 percent of this. Aspen site index at 80 years was generally low, ranging from 29 to 63 ft (8.8 to 19.2 m) and averaging only 42 ft (12.8 m). Aspen reproduction in these stands was also low. Less than 330 suckers/acre (800/ha) were produced on the average, of which about half were in the 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer reproduction averaged almost 650 stems/acre (1 600/ha), with 8 percent in the large size class. Over three-fourths of the conifer regeneration consisted of *A. concolor* seedlings.

Undergrowth production is generally low. Annual production ranged between 188 and 1,036 lb/acre (211 and 1 162 kg/ha), but averaged only 422 lb/acre (473 kg/ha). An average 39 percent of this was shrubs, 46 percent forbs, and 15 percent graminoids. What little vegetation was produced was generally considered good forage, with 51 percent in the desirable category. The type thus has relatively low value as livestock range because of sparse production. It appears to be of moderate value as wildlife habitat. Although undergrowth production is poor, considerable diversity exists in both overstory and undergrowth structure.

This seral aspen type has not been noted outside of Utah.

## *Populus tremuloides-Abies concolor/ Juniperus communis* Community Type (POTR-ABCO/JUCO c.t.)

This is primarily a southern Utah seral community type that was encountered principally in the Tushar Mountains and high plateaus to the south. We also observed the type at several locations on the south slope of the Uinta Mountains in northern Utah. The 20 stands sampled occurred at elevations between 7,400 and 9,200 ft (2 260 and 2 800 m), usually on less than 25 percent slopes, and were not restricted by exposure. The type appears adapted to a wide variety of soil parent materials.

The POTR-ABCO/JUCO c.t. represents the drier segment of aspen stands that are successional to *Abies concolor* coniferous forests. The type is characterized by the conspicuous presence and potential dominance of *A. concolor* or *Picea pungens* in the tree overstory and a distinct low shrub layer dominated by *Juniperus communis*. Although *Symphoricarpos oreophilus* may be present in the shrub layer, it is usually of lesser abundance. The herbaceous undergrowth consists of a variable assortment of such graminoids as *Stipa occidentalis, Bromus anomalus, Carex rossii*, and *Sitanion hystrix*, and such forbs as *Astragalus miser, Achillea millefolium, Frageria vesca*, and *Thalictrum fendleri*.

The natural succession process leads to dominance by *A. concolor* or *P. pungens* or both in the tree layer and subsequent suppression of undergrowth production by

greater intensity of shading and competition. The type most likely represents a seral stage within either the *A. concolor/J. communis* or perhaps the *P. pungens/ J. communis* habitat types that occur in central and southern Utah (Youngblood and Mauk 1985).

Heavy livestock use may lead to an increase in *J. communis* and *Berberis repens* in the shrub stratum, and an increase in *S. hystrix, A. miser, A. millefolium,* and *F. vesca* in the herbaceous layer. *Poa pratensis* and *Taraxacum officinale* are also likely to increase under abusive grazing.

Production was not sampled in this minor aspen type. Production of wood, however, is probably somewhat less than the 177 ft$^2$/acre (40.7 m$^2$/ha) basal area measured in the more moist POTR-ABCO/SYOR c.t. Undergrowth production is probably less than the low 422 lb/acre (473 kg/ha) measured for the POTR-ABCO/SYOR type. Composition of the undergrowth indicates moderately good forage suitability with 41 percent of the undergrowth cover in the desirable class. Lack of overall production makes this type rather poor livestock range. The type is of only moderate value as wildlife habitat.

This seral community type has not been noted outside of Utah.

## *Populus tremuloides-Pseudotsuga menziesii/Amelanchier alnifolia* Community Type (POTR-PSME/AMAL c.t.)

This is a fairly local seral community type in the Bear River and Wasatch Ranges of northern Utah. One stand, however, was sampled in the LaSal Mountains of southeastern Utah. The type occurs at relatively low elevations. The northern Utah stands were at elevations between 6,000 and 7,850 ft (1 830 and 2 390 m). The stands occupied primarily steep, north-facing or east-facing slopes. They were on soils derived from sandstone, limestone, or quartzite parent materials.

The vegetation of this type consists of a complex, multilayered assemblage of species. The *Populus tremuloides*-dominated tree stratum includes *Pseudotsuga menziesii* as a prominent conifer constituent. A tall shrub element is generally dominated by *Amelanchier alnifolia, Prunus virginiana,* or *Acer grandidentatum.* A distinct low shrub layer also exists in which *Symphoricarpos oreophilus* is the usual dominant, but which also frequently contains *Pachistima myrsinites, Rosa woodsii,* and *Berberis repens.* The herbaceous stratum contains a wide and variable assortment of species. Potentially prominent grasses are *Bromus carinatus, Elymus glaucus,* and *Agropyron trachycaulum.* Occasionally the sedge *Carex geyeri* is abundant. The most constant and abundant forbs are *Osmorhiza chilensis, Thalictrum fendleri, Geranium viscosissimum, Lathyrus* spp., and *Smilacina racemosa.*

This type is a successional stage leading to a *P. menziesii* forest climax. Undergrowth species similarities suggest the type represents a seral stage within several different habitat types described by Mauk and Henderson (1984). These include the *P. menziesii/ O. chilensis, P. menziesii/Acer glabrum,* and *P. menziesii/ B. repens* habitat types.

Heavy livestock use is likely to cause a decrease in abundance of *S. oreophilus* and *A. alnifolia* and an increase in less palatable species such as *B. repens, Achillea millefolium,* and *G. viscosissimum.* In addition, heavy use by sheep will tend to suppress *O. chilensis, T. fendleri,* and *Lathyrus* spp. to the benefit of *B. carinatus, E. glaucus,* and *C. geyeri.* On the other hand, heavy cattle use will tend to suppress the graminoids and favor the forbs.

The type appears to be moderately productive for trees. Basal area averaged 160 ft$^2$/acre (36.7 m$^2$/ha) and ranged between 105 and 283 ft$^2$/acre (24.2 and 64.9 m$^2$/ha). An average 14 percent of this basal area consisted of conifers. Site index at 80 years for aspen ranged between 50 and 66 ft (15.2 and 20.1 m) and averaged a relatively high 60 ft (18.3 m). Aspen reproduction in these stands averaged a moderate 2,900 suckers/acre (7 200/ha), about half of which were in the 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer regeneration was not great. Only 338 stems/acre (836/ha) were recorded, and only 13 percent of these were in the large size class.

Undergrowth is not very productive in this type. It ranged between 561 and 994 lb/acre (630 and 1 115 kg/ha) and averaged a low to moderate 748 lb/acre (839 kg/ha). This production was well distributed among the various vegetation classes: 38 percent shrubs, 41 percent forbs, and 21 percent graminoids. Of the undergrowth, 45 percent was desirable forage and 47 percent of intermediate suitability. Thus, the type is rather mediocre range for livestock. However, it is considered good habitat for wildlife because of the great amount of vegetation diversity. The tree layer consists of both aspen and conifers, while the undergrowth is composed of tall shrubs, low shrubs, forbs, and graminoids.

Similar aspen communities seral to *P. menziesii*-dominated forests have been noted in Idaho and Wyoming. Mueggler and Campbell (1982) identified a similar *P. tremuloides-P. menziesii/P. virginiana* c.t. on the Caribou and Targhee National Forests. Youngblood and Mueggler (1981) observed a somewhat similar *P. tremuloides-P. menziesii/Spiraea betulifolia* type in eastern Wyoming; unlike the Utah type, however, theirs had an abundance of *Spiraea.* In addition, *P. tremuloides* was recognized by Steele and others (1983) as a major seral tree in both the *P. menziesii/O. chilensis* and *P. menziesii/B. repens* habitat types in eastern Idaho and western Wyoming.

## *Populus tremuloides-Pseudotsuga menziesii/Juniperus communis* Community Type (POTR-PSME/JUCO c.t.)

The POTR-PSME/JUCO c.t. is a minor but widely distributed seral type. Five of the eight stands sampled were on the south slope of the Uinta Mountains in northern Utah. The remainder were on the Markagunt and Aquarius Plateaus in southern Utah. The type inhabits the upper elevation portion of the *Pseudotsuga menziesii* zone, with three-fourths of the stands at elevations exceeding 8,000 ft (2 440 m). The stands were primarily on relatively gentle slopes and on soils derived from either sedimentary or volcanic parent materials.

This community type is the drier of the two aspen types identified as successional to a climax *P. menziesii* forest. The vegetation is characterized by the conspicuous presence of *P. menziesii* in the tree layer, absence of a distinct tall shrub stratum, and the prominence of *Juniperus communis* in the low shrub layer. Occasionally *Pinus contorta* will also occur in some abundance in the tree layer. *Symphoricarpos oreophilus* and *Berberis repens* are frequent and often abundant members of the low shrub layer. The herbaceous stratum usually consists of a variable mixture of grasses and forbs. The most consistently occurring grasses are *Stipa occidentalis, Agropyron trachycaulum, Poa fendleriana*, and *Sitanion hystrix*. Frequently prominent forbs are *Astragalus miser, Fragaria vesca, Lupinus argenteus*, and *Taraxacum officinale*. Species diversity is ordinarily low.

The type is recognized as a seral stage within the *P. menziesii* climax forest series. It appears most closely related to the *P. menziesii/B. repens* and *P. menziesii/S. oreophilus* habitat types described by Mauk and Henderson (1984) for northern Utah and by Youngblood and Mauk (1985) for central and southern Utah.

Heavy livestock grazing tends to favor the production of *B. repens, A. miser, Fragaria vesca*, and *T. officinale* at the expense of *P. fendleriana, S. occidentalis, A. trachycaulum*, and *S. oreophilus*.

Production was not sampled in this infrequently encountered type. However, production of both trees and undergrowth will probably be somewhat less than in the more moist POTR-PSME/AMAL c.t., which averaged 160 $ft^2$/acre (36.7 $m^2$/ha) of tree basal area and 748 lb/acre (839 kg/ha) of undergrowth. Composition of the undergrowth indicates moderately good forage suitability for livestock, with 41 percent desirable and 48 percent intermediate. Value of the type as wildlife habitat is low to moderate, considerably less than in the POTR-PSME/AMAL c.t., because of the absence of a tall shrub layer.

This seral community type has not been reported to occur elsewhere.

## *Populus tremuloides-Pinus ponderosa/ Quercus gambelii* Community Type (POTR-PIPO/QUGA c.t.)

This minor seral community type is in the LaSal and Abajo Mountains, the Aquarius Plateau, and as far north as the southern edge of the Uinta Mountains. The six sampled stands grew at elevations between 7,500 and 8,800 ft (2 290 and 2 680 m), primarily on gently sloping, southerly exposures. The majority of stands occurred on soils derived from sandstone parent material, but volcanic soils also support the type.

The vegetation of this community type is unique because of the presence of *Pinus ponderosa* as virtually the sole conifer associated with *Populus tremuloides* in the tree stratum and the presence of a tall shrub element in the undergrowth. *Quercus gambelii* is usually the primary tall shrub species, but *Prunus virginiana* or *Acer grandidentatum* may fill this role. Frequently *Symphoricarpos oreophilus* forms a distinct low shrub layer. The herbaceous undergrowth is usually rather sparse and consists of such species as *Achillea millefolium, Thermopsis montana, Thalictrum fendleri, Ligusticum porteri, Poa pratensis*, and *Taraxacum officinale*.

Normal succession in this type slowly leads to *P. tremuloides* replacement by *P. ponderosa*. In northern Utah the type is most likely a seral stage with the *P. ponderosa/Carex geyeri* habitat type (Mauk and Henderson 1984), whereas in central and southern Utah it probably is within either the *P. ponderosa/Q. gambelii* or *P. ponderosa/S. oreophilus* habitat types (Youngblood and Mauk 1985).

Only a single stand in this type was sampled for productivity. Tree basal area was a fairly high 170 $ft^2$/acre (39.1 $m^2$/ha), of which 26 percent was conifers. Aspen site index at 80 years was a low 40 ft (12.2 m). Only 567 suckers/acre (1 402/ha) were encountered in this stand; a third of these were in the 1- to 4.6-ft (0.3- to 1.4-m) size class. Only 13 conifer seedlings/acre (32/ha) were present, all of which were *P. ponderosa* in the large size class.

Production of undergrowth was a low 707 lb/acre (794 kg/ha). This was about equally divided between shrubs, forbs, and graminoids. A relatively high 50 percent of this was classified as desirable and 42 percent of intermediate forage suitability. The type is considered poor to fair range for livestock and at least moderate to good wildlife habitat.

This community type has not been identified outside of Utah.

## *Populus tremuloides-Pinus ponderosa/ Juniperus communis* Community Type (POTR-PIPO/JUCO c.t.)

The POTR-PIPO/JUCO c.t. is a minor but widely dispersed type observed along the eastern portion of the Uinta Mountains in northern Utah and on the Markagunt and Aquarius Plateaus in southern Utah. The 14 stands sampled in this type occurred at elevations between 7,600 and 8,900 ft (2 320 and 2 710 m), on gentle slopes, and on soils derived from a wide variety of parent materials.

This is the most common of the two community types where *Pinus ponderosa* becomes prominently associated with aspen (fig. 15). The undergrowth in this type is characterized by the virtual absence of tall shrubs and the prominence of *Juniperus communis* in the low shrub layer. *Symphoricarpos oreophilus* and *Berberis repens* frequently accompany *J. communis* in the low shrub layer. The usually sparse herb stratum consists of a variable mixture of such relatively dry-site grasses as *Sitanion hystrix, Stipa comata*, and *Poa fendleriana*, and such forbs as *Astragalus miser, Antennaria microphylla, Fragaria vesca*, and *Taraxacum officinale*. None of these herbaceous species has high constancy.

This aspen-dominated type is considered a seral stage within the *P. ponderosa* forest series. It appears most closely associated with the *P. ponderosa/Festuca idahoensis* habitat type (Mauk and Henderson 1984) of northern Utah, and possibly the *P. ponderosa/*

Figure 15.—The minor though wide-ranging *Populus tremuloides-Pinus ponderosa/Juniperus communis* c.t. represents one of the driest aspen types successional to coniferous forests. This stand on the Markagunt Plateau, Dixie N.F., has typically sparce undergrowth in which *J. communis, Poa fendleriana, Sitanion hystrix, Antennaria rosea,* and *Achillea millefolium* are prominent species.

*S. oreophilus* habitat type (Youngblood and Mauk 1985) of central and southern Utah.

Production was sampled on only one stand in this type. Tree basal area was 193 $ft^2$/acre (44.3 $m^2$/ha) in this stand, which appears to be high for the *P. ponderosa* climax forest series. Conifers were 42 percent of the basal area. Aspen site index at 80 years was a fairly high 57 ft (17.4 m). Reproduction was low for both aspen and conifers. Only 450 aspen suckers/acre (1 114/ha) and 51 conifer seedlings/acre (127/ha) were counted.

Undergrowth production was a low 428 lb/acre (480 kg/ha). An unusually high 65 percent of this was graminoids, 15 percent forbs, and 20 percent shrubs. Though meager in amount, the undergrowth was highly rated as livestock forage, with 55 percent classed desirable and 43 percent as intermediate suitability. The high proportion of grasses makes this type better suited as cattle range than as sheep range. Wildlife habitat values appear low to moderate because of limited structural and species diversity of the vegetation.

This seral aspen type has not been reported to occur elsewhere.

## *Populus tremuloides-Pinus contorta/ Vaccinium scoparium* Community Type (POTR-PICO/VASC c.t.)

This minor, local type occurred only on the north slope of the Uinta Mountains in northern Utah. The six sampled stands occupied only soils of quartzite origin. They grew at elevations between 7,700 and 9,100 ft (2 350 and 2 770 m).

The community type is characterized by the abundance of *Pinus contorta* associated with *Populus tremuloides* in the overstory and a low shrub complex dominated by *Vaccinium scoparium* or possibly *Vaccinium caespitosum*. Frequently *Abies lasiocarpa* may also be present in the tree layer but only in minor amounts. Shrubs likely to be encountered in the undergrowth associated with the *Vaccinium* spp. include *Berberis repens, Pachistima myrsinites,* and *Juniperus communis*. The only herbaceous species with high constancy and coverage is the sedge *Carex geyeri*. Other herbs often present in varying amounts include *Osmorhiza chilensis, Galium boreale, Elymus glaucus, Trisetum spicatum, Lathyrus* spp., *Arnica latifolia*, and *Antennaria microphylla*.

Mauk and Henderson (1984) recognized a *P. contorta/ V. scoparium* c.t. in the Uinta Mountains that resembles our POTR-PICO/VASC type. *P. contorta* is more shade tolerant than *P. tremuloides* and will eventually dominate these stands. *Abies lasiocarpa*, on the other hand, is more shade tolerant than *P. contorta* and where adapted will eventually replace *P. contorta*. Mauk and Henderson (1984) suggest that on some sites the *P. contorta/V. scoparium* c.t. reflects true climax vegetation and thus qualifies as a habitat type. On other sites this conifer type appears to be a successional stage within an *A. lasiocarpa/V. scoparium* habitat type. Thus, it appears that the POTR-PICO/VASC c.t. is a seral stage within both the *P. contorta/V. scoparium* and *A. lasiocarpa/V. scoparium* habitat types. In any event, the natural course of succession on these sites will lead to the demise of the aspen overstory and conifer dominance.

This minor type was not sampled for production. We assume, however, that tree growth may be approximately the same, if not slightly greater, than the 135 $ft^2$/acre (31.0 $m^2$/ha) basal area in POTR-PICO/JUCO type. Aspen site index in this latter type was a low 42 ft (12.9 m) at 80 years. Undergrowth production also may be similar to the low 603 lb/acre (677 kg/ha) found in the POTR-PICO/JUCO c.t. The POTR-PICO/VASC c.t. is relatively poor livestock range and of no more than moderate value as wildlife habitat.

Although this seral type has not been reported elsewhere, it probably can occur in Colorado. We believe that this type is probably seral to the *A. lasiocarpa/ V. scoparium* habitat type (Mauk and Henderson 1984) in Utah; *P. tremuloides* is also recognized as a seral tree in the same habitat type in northwestern Colorado (Hoffman and Alexander 1980, 1983).

## *Populus tremuloides-Pinus contorta/ Juniperus communis* Community Type (POTR-PICO/JUCO c.t.)

The POTR-PICO/JUCO c.t. is a local seral type encountered only in the Uinta Mountains of northern Utah, where it is fairly common. It occurs on both the north and south flanks of this range at elevations usually above 8,000 ft (2 440 m). The 29 stands sampled in this type were not restricted by either slope or exposure but were confined primarily to soils derived from either sandstone or quartzite parent materials.

This is the more common of the two community types in which *Pinus contorta* is strongly associated with *Populus tremuloides* in the tree overstory. The undergrowth is composed of a low shrub layer dominated by *Juniperus communis* and an herb layer in which various graminoids are usually prominent. *Berberis repens* and *Rosa woodsii* are the shrubs most commonly associated with *J. communis*, but occasionally *Arctostaphylos uva-ursi* or *Symphoricarpos oreophilus* may occur in some abundance. *Carex geyeri, Stipa occidentalis, Agropyron trachycaulum*, and *Bromus ciliatus* are usually the most prominent graminoids. The forb component consists of a mixture of species. The most common are *Achillea millefolium, Astragalus miser, Lupinus argenteus, Geranium viscosissimum, Thalictrum fendleri, Antennaria microphylla, Fragaria vesca*, and *Potentilla gracilis*.

The seral status of the POTR-PICO/JUCO c.t. is apparent from the abundance of *P. contorta* in the tree overstory. Succession is obviously away from dominance by *P. tremuloides* and toward dominance by the more shade-tolerant conifer. Undergrowth similarities suggest that succession may be toward the *P. contorta/B. repens* or possibly the *P. contorta/J. communis* community types. Mauk and Henderson (1984) indicate that the *P. contorta/B. repens* type is climax in some situations. In others, particularly where *C. geyeri* is abundant and *Abies lasiocarpa* is present, it is a seral type within the *A. lasiocarpa/B. repens* habitat type. Mauk and Henderson consider the *P. contorta/J. communis* community type to be primarily a seral stage within the *A. lasiocarpa/J. communis* habitat type. Thus, the POTR-PICO/JUCO type may represent a seral stage within at least three habitat types: *P. contorta/B. repens, A. lasiocarpa/B. repens*, and *A. lasiocarpa/J. communis*.

Tree production within this type is low to moderate. Basal area ranged from 104 to 178 $ft^2$/acre (23.8 to 40.8 $m^2$/ha) and averaged 135 $ft^2$/acre (31.0 $m^2$/ha). Of this basal area, 16 percent was conifers, primarily *P. contorta*. Aspen site index at 80 years ranged from 37 to 51 ft (11.3 to 15.5 m) and averaged a low 42 ft (12.9 m). Aspen reproduction averaged a low 676 suckers/acre (1 670/ha), but 70 percent of these were in the 1- to 4.6-ft (0.3- to 1.4-m) size class. Conifer regeneration averaged 236 seedlings/acre (584/ha), of which 30 percent were in the larger size class. Approximately half of these seedlings were *P. contorta*, the other half *Abies lasiocarpa*.

Undergrowth production is low, ranging from 290 to 824 lb/acre (326 to 925 kg/ha) and averaging only 603 lb/acre (677 kg/ha). Of this, 8 percent was shrubs, primarily *J. communis*, 71 percent forbs, and 21 percent graminoids. The undergrowth is moderately desirable as forage with 44 percent in the desirable class and 51 percent in the intermediate class. But this type is rather poor range for livestock because of low forage production. It has only moderate value as wildlife habitat.

This seral type is not known to occur outside of the Uinta Mountains in northeastern Utah.

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# APPENDIX A: CONSTANCY AND AVERAGE CANOPY COVER (LATTER IN PARENTHESES) OF IMPORTANT PLANT SPECIES IN ASPEN COMMUNITY TYPES IN UTAH

| | ALL STANDS CLAS-SIFIED | POTR/ ACGR/ PTAQ C.T. | POTR/ PRVI/ SESE C.T. | POTR/ PRVI/ CAGE C.T. | POTR/ SARA C.T. | POTR/ SYOR/ SESE C.T. | POTR/ SYOR/ CAGE C.T. | POTR/ SYOR/ FETH C.T. | POTR/ SYOR/ BRCA C.T. | POTR/ SYOR/ POPR C.T. | POTR/ JUCO/ CAGE C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 1179 | 11 | 114 | 12 | 16 | 151 | 61 | 7 | 12 | 30 | 70 |
| TREES | | | | | | | | | | | |
| ABIES CONCOLOR | 10( 8) | 27( 3) | 14( 1) | 17( T) | -( -) | 17( 1) | 5( 7) | 14( T) | 8( T) | -( -) | 4( 4) |
| ABIES LASIOCARPA | 38(12) | 9( 1) | 6( 1) | 8( 3) | 31( 2) | 23( T) | 23( 1) | -( -) | 50( 1) | 3( T) | 17( 1) |
| PICEA ENGELMANNII | 13( 7) | -( -) | 1( T) | -( -) | 6( T) | 1( 2) | 10( 1) | 29( T) | -( -) | 3( 1) | 16( T) |
| PICEA PUNGENS | 5( 7) | -( -) | -( -) | -( -) | -( -) | 1( T) | 3( 1) | -( -) | -( -) | 7( T) | 9( 1) |
| PINUS CONTORTA | 10(11) | -( -) | 1( 4) | 8( 4) | -( -) | 1( 1) | -( -) | -( -) | 17( 6) | 7( 2) | 33( 2) |
| PINUS FLEXILIS | 5( 2) | -( -) | -( -) | -( -) | -( -) | -( -) | 8( T) | -( -) | -( -) | 3( T) | 7( T) |
| PINUS PONDEROSA | 5(10) | -( -) | -( -) | 8( T) | -( -) | -( -) | 5( T) | 14( T) | -( -) | 13( 1) | 6( 1) |
| POPULUS TREMULOIDES | 100(72) | 100(71) | 100(76) | 100(78) | 100(71) | 100(71) | 100(78) | 100(83) | 100(65) | 100(73) | 100(76) |
| PSEUDOTSUGA MENZIESII | 17( 4) | -( -) | 12( 2) | 17( T) | -( -) | 8( 1) | 39( 2) | 43( 3) | 25( 2) | 7( 1) | 23( 1) |
| SHRUBS | | | | | | | | | | | |
| ACER GLABRUM | 1( 2) | 9( T) | 4( 4) | -( -) | -( -) | 1( 1) | 2( T) | -( -) | -( -) | -( -) | 1( 2) |
| ACER GRANDIDENTATUM | 10(13) | 91(16) | 46(19) | 33(41) | -( -) | 8( T) | 5( T) | -( -) | 17( 3) | 13( 1) | 1( T) |
| AMELANCHIER ALNIFOLIA | 26( 5) | 55( 6) | 72( 9) | 92(10) | 6( 2) | 27( 2) | 28( 1) | 14( T) | 50( 2) | 30( 2) | 19( 1) |
| ARCTOSTAPHYLOS UVA-URSI | 3( 6) | -( -) | -( -) | 17( 2) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 16( 8) |
| ARTEMISIA TRIDENTATA | 9( 4) | -( -) | 3( 4) | -( -) | -( -) | 10( 3) | 13( T) | -( -) | 17( 1) | 20( 2) | 31( 8) |
| BERBERIS REPENS | 36( 5) | 36(22) | 49( 5) | 75(16) | -( -) | 21( 3) | 43( 8) | 71(17) | 67( 1) | 43( 6) | 51( 7) |
| CEANOTHUS VELUTINUS | 1( 7) | -( -) | 4( 7) | 17(19) | -( -) | 1( T) | -( -) | -( -) | 17(10) | -( -) | -( -) |
| CHRYSOTHAMNUS VISCIDIFLORUS | 2( 4) | -( -) | 1( T) | 8( T) | -( -) | 1( T) | 5( 7) | -( -) | 8( 1) | 7( T) | 3(33) |
| JUNIPERUS COMMUNIS | 25( 9) | -( -) | 2( 1) | 25( 4) | -( -) | 1( T) | 16( 1) | 29(12) | 8( T) | 23( 7) | 96(15) |
| PACHISTIMA MYRSINITES | 12( 4) | 9( 1) | 24(11) | 50( 5) | -( -) | 6( 1) | 11( 1) | -( -) | 25( 1) | 7( T) | 3( T) |
| PHYSOCARPUS MALVACEUS | 3(13) | 18(11) | 11(14) | 25(19) | 6( 5) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| PRUNUS VIRGINIANA | 19(12) | 82(10) | 86(23) | 83(13) | 6( 5) | 29( 2) | 11( 6) | -( -) | 17( T) | 23( 2) | -( -) |
| QUERCUS GAMBELII | 4( 7) | 9(10) | 11( 2) | 33(22) | -( -) | 2( T) | 5( 3) | -( -) | 8( 5) | 10( 3) | -( -) |
| RIBES LACUSTRE | 2( 5) | -( -) | 2(38) | -( -) | 6( 5) | 3( 1) | -( -) | -( -) | -( -) | 7( 3) | 1( 3) |
| RIBES MONTIGENUM | 3( 2) | -( -) | -( -) | -( -) | 25( 6) | 1(10) | -( -) | -( -) | -( -) | -( -) | -( -) |
| RIBES SP. | 7( 1) | -( -) | 10( 1) | 8( T) | 19( 3) | 7( T) | 11( 1) | -( -) | -( -) | -( -) | 3( 1) |
| ROSA WOODSII | 36( 2) | 55( 2) | 56( 3) | 83( 2) | 6( T) | 34( 1) | 56( 2) | 86( 5) | 42( 1) | 33( 6) | 39( 1) |
| RUBUS PARVIFLORUS | 3( 4) | 9( T) | 5( 2) | -( -) | 6( T) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SALIX SCOULERIANA | 3( 3) | -( -) | 5( 4) | 8( 8) | 6(10) | 1( 3) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SAMBUCUS RACEMOSA | 14( 3) | 27( 2) | 17( 2) | -( -) | 88(20) | 15( 2) | 3( T) | -( -) | -( -) | 3( T) | 1( T) |
| SHEPHERDIA CANADENSIS | 3( 1) | -( -) | 3( T) | -( -) | -( -) | 1( T) | 2( T) | -( -) | -( -) | -( -) | 1( T) |
| SORBUS SCOPULINA | 2( 4) | -( -) | 4(17) | -( -) | 13( 5) | 1( 2) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SYMPHORICARPOS OREOPHILUS | 74(18) | 55( 7) | 93(25) | 83(20) | 44( 3) | 100(32) | 100(33) | 100(26) | 100(27) | 100(29) | 79( 8) |
| VACCINIUM CAESPITOSUM | 1( 7) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| VACCINIUM SCOPARIUM | 1( 8) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| GRAMINOIDS | | | | | | | | | | | |
| AGROPYRON TRACHYAULUM | 56( 4) | 45( T) | 46( 3) | 67( 4) | 69( 2) | 68( 4) | 61( 6) | 43( 1) | 83( 7) | 67( 3) | 70( 3) |
| ARRHENATHERUM ELATIUS | 1(11) | 9( T) | 1( T) | -( -) | -( -) | 1(22) | -( -) | -( -) | 8( T) | 3(45) | -( -) |
| BROMUS ANOMALUS | 9( 7) | -( -) | 2(20) | -( -) | -( -) | -( -) | 18( 5) | 57( 8) | -( -) | -( -) | 11(22) |
| BROMUS CARINATUS | 48(10) | 64( 7) | 59( 5) | 33( 1) | 81(19) | 79( 9) | 15( 5) | -( -) | 100(24) | 30( 1) | 20( 5) |
| BROMUS CILIATUS | 12( 3) | -( -) | 4( 5) | 33( 4) | -( -) | 1( T) | 13( 3) | 29( 3) | 8( T) | 7( 5) | 26( 2) |
| CALAMAGROSTIS RUBESCENS | 1(27) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| CAREX GEYERI | 20(16) | -( -) | 14( 2) | 75(25) | 6( 2) | 7( 6) | 41(25) | -( -) | 8( T) | -( -) | 61(21) |
| CAREX HOODII | 15( 3) | -( -) | 20( 1) | 8( 3) | 25( 2) | 24( 2) | 8( 4) | -( -) | 33( 3) | 7( T) | 7( 1) |
| CAREX OBTUSATA | 1(11) | -( -) | -( -) | -( -) | -( -) | -( -) | 3(20) | -( -) | -( -) | -( -) | 1( 4) |
| CAREX ROSSII | 15( 4) | -( -) | 3( 1) | -( -) | -( -) | 1( T) | 11( 6) | -( -) | 8( 1) | 10( 1) | 17( 3) |
| DACTYLIS GLOMERATA | 6( 5) | 9( T) | 6( 6) | -( -) | -( -) | 13( 3) | -( -) | -( -) | 17(15) | 10( 2) | -( -) |
| ELYMUS CINEREUS | 1( 8) | -( -) | 4( 2) | -( -) | -( -) | 3(23) | -( -) | -( -) | 8( T) | 10( 1) | -( -) |
| ELYMUS GLAUCUS | 33(12) | 82(16) | 74(15) | 42( 5) | 44( 9) | 48(10) | 16( 5) | -( -) | 67(13) | 10( 4) | 4( 5) |
| FESTUCA IDAHOENSIS | 3( 4) | -( -) | -( -) | -( -) | -( -) | 1( 3) | 7( 5) | -( -) | -( -) | 7( 4) | 10( 6) |
| FESTUCA THURBERI | 4( 9) | -( -) | -( -) | 8( 3) | -( -) | -( -) | 7( 2) | 100(15) | -( -) | 3( T) | 1( 5) |
| KOELERIA CRISTATA | 2( 2) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | 4( 1) |
| LEUCOPOA KINGII | 1( 4) | -( -) | 2( 2) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 3( 1) | -( -) |
| MELICA SPECTABILIS | 9( 1) | -( -) | 4( 1) | 17( T) | 31( 1) | 8( T) | 5( 1) | -( -) | 17( 3) | 3( T) | 6( T) |
| PHLEUM ALPINUM | 2( 1) | -( -) | -( -) | -( -) | -( -) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| POA FENDLERIANA | 7( 3) | -( -) | -( -) | 8( T) | -( -) | -( -) | 15( 3) | 14( 3) | 8( T) | 7( 2) | 11( 6) |
| POA NERVOSA | 16( 2) | 9( T) | 15( 2) | -( -) | 31( 2) | 21( 1) | 5( 9) | -( -) | 8( T) | 3( 2) | 6( 1) |
| POA PRATENSIS | 33(16) | 27( 1) | 35(21) | 33(21) | 13( T) | 37(19) | 48( 8) | 14(10) | 50(28) | 97(31) | 33( 8) |
| SITANION HYSTRIX | 9( 3) | -( -) | -( -) | -( -) | -( -) | -( -) | 18( 1) | 29( T) | -( -) | 7( T) | 10( 1) |
| STIPA COMATA | 4( 8) | -( -) | -( -) | -( -) | -( -) | -( -) | 5( 4) | -( -) | -( -) | 3( T) | 10( 4) |
| STIPA LETTERMANII | 7( 3) | -( -) | 1( T) | -( -) | 6( T) | 1( T) | 18( 6) | 14( 2) | -( -) | 10( T) | 9( 3) |
| STIPA OCCIDENTALIS | 33( 6) | 9( T) | 12( 1) | 58(18) | 13( 2) | 17( 2) | 67( 9) | 43( 3) | 33( 8) | 17( 2) | 86( 8) |
| TRISETUM SPICATUM | 8( 1) | -( -) | -( -) | -( -) | 13( T) | -( -) | 2( T) | -( -) | -( -) | -( -) | 14( 1) |

# APPENDIX A. (Con.)

| | ALL STANDS CLAS- SIFIED | POTR/ ACGR/ PTAQ C.T. | POTR/ PRVI/ SESE C.T. | POTR/ PRVI/ CAGE C.T. | POTR/ SARA C.T. | POTR/ SYOR/ SESE C.T. | POTR/ SYOR/ CAGE C.T. | POTR/ SYOR/ FETH C.T. | POTR/ SYOR/ BRCA C.T. | POTR/ SYOR/ POPR C.T. | POTR/ JUCO/ CAGE C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 1179 | 11 | 114 | 12 | 16 | 151 | 61 | 7 | 12 | 30 | 70 |
| FORBS | | | | | | | | | | | |
| ACHILLEA MILLEFOLIUM | 58( 2) | 9( T) | 55( 1) | 42( 1) | 50( T) | 52( 1) | 62( 1) | 86( T) | 75( 1) | 63( 1) | 67( 2) |
| ACTAEA RUBRA | 4( 4) | 9( 1) | 5( 3) | -( -) | 19( 1) | 4( 2) | -( -) | -( -) | -( -) | -( -) | -( -) |
| AGASTACHE URTICIFOLIA | 29( 5) | 36( 6) | 68( 6) | 8( T) | 31( 6) | 68( 5) | 3( T) | -( -) | 8( T) | 13( T) | -( -) |
| AGOSERIS GLAUCA | 6( T) | -( -) | 3( T) | -( -) | 13( T) | 3( T) | 3( T) | -( -) | 8( T) | -( -) | 17( T) |
| ALLIUM BREVISTYLUM | 3( 1) | -( -) | 5( T) | -( -) | -( -) | 9( T) | -( -) | -( -) | -( -) | 7( T) | 3( T) |
| ALLIUM CERNUUM | 2( T) | -( -) | -( -) | 8( T) | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | 10( T) |
| ANTENNARIA MICROPHYLLA | 11( 2) | -( -) | -( -) | 8( T) | -( -) | 1( T) | 15( 1) | -( -) | -( -) | 20( T) | 41( 3) |
| ANTENNARIA PARVIFOLIA | 1( 1) | -( -) | -( -) | -( -) | -( -) | -( -) | 3( T) | -( -) | -( -) | -( -) | 4( T) |
| APOCYNUM ANDROSAEMIFOLIUM | 2( 1) | 9( T) | 7( 2) | 17( 1) | -( -) | -( -) | -( -) | -( -) | 17( T) | -( -) | 1( T) |
| AQUILEGIA COERULEA | 16( 1) | 18( T) | 8( 1) | -( -) | 38( 1) | 22( 1) | 16( T) | 29( T) | -( -) | 10( T) | 13( 1) |
| ARENARIA CONGESTA | 2( 1) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 14( 1) |
| ARNICA CORDIFOLIA | 5( 2) | -( -) | 4( 5) | 17( 1) | -( -) | 2( 1) | 2( T) | -( -) | -( -) | 3( T) | 3( T) |
| ARNICA LATIFOLIA | 3( 9) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | 3( 8) |
| ARTEMISIA LUDOVICIANA | 2( 3) | -( -) | 1( T) | -( -) | 25( 3) | 2(14) | -( -) | 14( T) | 8( T) | 3( T) | -( -) |
| ASTER CHILENSIS | 4( 1) | -( -) | 8( T) | 17( T) | -( -) | 3( 2) | 8( 2) | -( -) | 17( T) | 7( 8) | 3( T) |
| ASTER ENGELMANNII | 23( 3) | 64( 3) | 56( 4) | -( -) | 38( 1) | 31( 4) | 3( 2) | -( -) | 8( T) | -( -) | -( -) |
| ASTER FOLIACEUS | 2( 3) | -( -) | 2( 2) | -( -) | -( -) | 5( 2) | -( -) | -( -) | -( -) | 3( 5) | -( -) |
| ASTER OCCIDENTALIS | 1(12) | -( -) | 1( 3) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 6(18) |
| ASTRAGALUS MISER | 15(10) | -( -) | 2( T) | 8(15) | -( -) | -( -) | 23(11) | -( -) | 8( T) | 3( 2) | 51(13) |
| CAMPANULA ROTUNDIFOLIA | 2( T) | -( -) | -( -) | 8( T) | -( -) | -( -) | 2( T) | -( -) | -( -) | 7( T) | 17( T) |
| CASTILLEJA MINIATA | 12( 1) | -( -) | 10( T) | 8( T) | 6( 2) | 9( 1) | 11( T) | 57( T) | -( -) | 7( T) | 23( T) |
| CHENOPODIUM FREMONTII | 7( 1) | -( -) | 10( T) | -( -) | 25( T) | 7( 1) | 5( T) | 14( T) | -( -) | -( -) | 3( T) |
| CHLOROCRAMBE HASTATA | 2( 2) | -( -) | 5( T) | -( -) | -( -) | 3( 3) | -( -) | -( -) | -( -) | -( -) | -( -) |
| CIRCAEA ALPINA | 1(11) | 27( 8) | 4(16) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| CIRSIUM ARVENSE | 4( 1) | -( -) | 1( T) | -( -) | -( -) | 3( T) | 8( 2) | -( -) | -( -) | -( -) | 9( T) |
| CIRSIUM VULGARE | 1( 1) | -( -) | -( -) | 8( T) | -( -) | 2( 1) | 3( 3) | -( -) | -( -) | -( -) | 1( T) |
| CLEMATIS COLUMBIANA | 2( 1) | 36( 1) | 2( T) | -( -) | 6( T) | -( -) | -( -) | -( -) | -( -) | 3( T) | -( -) |
| COLLINSIA PARVIFLORA | 7( 4) | -( -) | 4( 1) | -( -) | -( -) | 6( 3) | -( -) | -( -) | 8( 2) | -( -) | 4( 4) |
| COLLOMIA LINEARIS | 12( 3) | -( -) | 9( 1) | 8( T) | 31( 2) | 23( 2) | 2( T) | -( -) | 8( 2) | -( -) | -( -) |
| CORALLORHIZA MACULATA | 4( T) | 9( T) | 3( T) | 8( T) | -( -) | 3( T) | 2( T) | 14( T) | 8( T) | 3( T) | 3( T) |
| DELPHINIUM NUTTALLIANUM | 7( T) | -( -) | 2( T) | 8( T) | -( -) | 4( T) | 13( T) | -( -) | -( -) | 20( T) | 7( T) |
| DELPHINIUM OCCIDENTALE | 13( 4) | 27( 2) | 11( 6) | -( -) | 50( 4) | 22( 5) | 2( T) | 14( T) | 8( T) | -( -) | 3( 1) |
| DESCURAINIA CALIFORNICA | 2( 2) | -( -) | -( -) | -( -) | 19( 3) | 3( 1) | -( -) | -( -) | -( -) | -( -) | -( -) |
| DESCURAINIA RICHARDSONII | 27( 1) | 36( 1) | 34( 1) | 8( T) | 69( 1) | 41( 1) | 28( T) | 43( T) | 17( T) | 10( T) | 3( T) |
| EPILOBIUM ANGUSTIFOLIUM | 5( T) | 9( T) | 9( 1) | 25( T) | -( -) | -( -) | 3( T) | -( -) | 8( T) | -( -) | 6( T) |
| ERIGERON FLAGELLARIS | 2( T) | -( -) | 1( T) | -( -) | -( -) | 1( T) | 5( 1) | -( -) | -( -) | 3( T) | -( -) |
| ERIGERON PEREGRINUS | 3( 3) | -( -) | 1( 1) | 8( 5) | -( -) | 1( 1) | -( -) | -( -) | -( -) | -( -) | 9( 3) |
| ERIGERON SPECIOSUS | 15( 1) | -( -) | 17( 2) | 8( T) | 6( 5) | 25( 2) | 13( 1) | -( -) | 17( 3) | 7( 3) | 16( T) |
| ERIGERON URSINUS | 1( 1) | -( -) | -( -) | -( -) | -( -) | -( -) | 3( T) | -( -) | -( -) | 7( T) | 3( T) |
| ERYTHRONIUM GRANDIFLORUM | 2( 2) | -( -) | 1( 3) | 8( T) | 13( 5) | 3( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| FRAGARIA VESCA | 21( 2) | -( -) | 16( 1) | 25( T) | 6( T) | 14( 3) | 13( 1) | 14( T) | 17( T) | 3( T) | 24( 1) |
| FRASERA SPECIOSA | 13( 1) | -( -) | 10( 1) | 25( 1) | -( -) | 11( 1) | 31( 2) | 14( T) | 8( T) | 7( T) | 17( 2) |
| GALIUM APARINE | 1( 4) | 9( 7) | 5( 1) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 1) |
| GALIUM BIFOLIUM | 13( 4) | 18( 2) | 14( 4) | -( -) | 38(12) | 24( 2) | 3( 5) | -( -) | -( -) | -( -) | 3( 3) |
| GALIUM BOREALE | 16( 1) | 45( 2) | 23( 1) | 33( T) | -( -) | 9( 1) | 20( 1) | -( -) | 25( T) | 13( 1) | 27( 1) |
| GERANIUM RICHARDSONII | 7( 5) | -( -) | -( -) | 8( T) | 6( T) | 7( 5) | 5( 3) | -( -) | -( -) | 3( 2) | 4( 2) |
| GERANIUM VISCOSISSIMUM | 31( 3) | 9( T) | 39( 3) | 42( T) | 13( T) | 37( 2) | 33( 2) | -( -) | 67( 5) | 27( 3) | 59( 6) |
| HABENARIA UNALASCENSIS | 3( T) | -( -) | 9( T) | 8( T) | -( -) | -( -) | -( -) | -( -) | 17( T) | -( -) | 4( T) |
| HACKELIA FLORIBUNDA | 25( 3) | -( -) | 37( 2) | 17( T) | 31( 2) | 48( 4) | 7( 2) | -( -) | 33( 4) | 20( 3) | 7( T) |
| HAPLOPAPPUS PARRYI | 2( 2) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | 4( 1) |
| HELENIUM HOOPESII | 6( 2) | -( -) | 2( T) | -( -) | 13( T) | 1( 3) | 8( 2) | 29( T) | -( -) | 20( 1) | -( -) |
| HELIANTHELLA UNIFLORA | 2( 4) | -( -) | 3( T) | -( -) | -( -) | 2( 2) | 2( 2) | -( -) | -( -) | 3( T) | -( -) |
| HERACLEUM LANATUM | 6( 8) | 27( 6) | 11( 7) | -( -) | -( -) | 10( 3) | -( -) | -( -) | -( -) | -( -) | -( -) |
| HIERACIUM ALBIFLORUM | 2( T) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 17( T) | -( -) | 3( T) |
| HYDROPHYLLUM CAPITATUM | 8( T) | 9( T) | 9( T) | 8( T) | 19( T) | 13( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| HYDROPHYLLUM FENDLERI | 1(18) | -( -) | 3(38) | -( -) | 6(20) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| IRIS MISSOURIENSIS | 1( 4) | -( -) | 1( 4) | -( -) | -( -) | -( -) | 8( T) | -( -) | -( -) | 10( T) | -( -) |
| LATHYRUS ARIZONICUS | 1(31) | -( -) | -( -) | -( -) | -( -) | -( -) | 5(24) | 14(38) | -( -) | -( -) | -( -) |
| LATHYRUS LANSZWERTII | 28(16) | 18( 5) | 39(10) | 17( 7) | 38(17) | 42(17) | 13(23) | 43(18) | 33(10) | 13( 9) | 6(24) |
| LATHYRUS LEUCANTHUS | 15(19) | 9(13) | 21(15) | 17(17) | 13(29) | 13(13) | 30(30) | 29(18) | 25( 3) | 17(12) | 3(28) |
| LATHYRUS PAUCIFLORUS | 6( 3) | 27( 3) | 14( 7) | -( -) | 19( 1) | 10( 2) | -( -) | -( -) | 8( T) | -( -) | -( -) |
| LIGUSTICUM FILICINUM | 3( 3) | -( -) | -( -) | -( -) | 25( 4) | 3( 1) | 2( T) | -( -) | -( -) | -( -) | 1( T) |
| LIGUSTICUM PORTERI | 11( 3) | -( -) | 3(10) | 8( 2) | 19( T) | 3( 2) | 38( 3) | 29( 4) | -( -) | 3( 2) | 10( 3) |
| LUPINUS ARGENTEUS | 23( 7) | 9( T) | 17( 4) | 25(11) | -( -) | 11( 8) | 43( 5) | 29( T) | 17(10) | 50( 3) | 56( 9) |
| LUPINUS CAUDATUS | 2( 3) | -( -) | 3( 1) | -( -) | -( -) | 3( 2) | -( -) | -( -) | 25( 1) | 7( 1) | -( -) |

| | ALL STANDS CLAS- SIFIED | POTR/ ACGR/ PTAQ C.T. | POTR/ PRVI/ SESE C.T. | POTR/ PRVI/ CAGE C.T. | POTR/ SARA C.T. | POTR/ SYOR/ SESE C.T. | POTR/ SYOR/ CAGE C.T. | POTR/ SYOR/ FETH C.T. | POTR/ SYOR/ BRCA C.T. | POTR/ SYOR/ POPR C.T. | POTR/ JUCO/ CAGE C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 1179 | 11 | 114 | 12 | 16 | 151 | 61 | 7 | 12 | 30 | 70 |
| FORBS (CONT'D) | | | | | | | | | | | |
| MERTENSIA ARIZONICA | 20( 8) | 9( 5) | 25( 4) | 8( T) | 50(14) | 37( 8) | 3( T) | 14( T) | -( -) | 3( T) | -( -) |
| MERTENSIA CILIATA | 1(10) | -( -) | 2( 3) | -( -) | 6(10) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| MERTENSIA FRANCISCANA | 2( 7) | -( -) | 1( T) | -( -) | 6( 3) | -( -) | 7( 5) | -( -) | -( -) | 3( T) | -( -) |
| MERTENSIA LONGIFLORA | 1( 9) | -( -) | 3( T) | -( -) | -( -) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| NEMOPHILA BREVIFLORA | 15(14) | 45(12) | 19( 6) | -( -) | 25(11) | 28(11) | -( -) | -( -) | 8( T) | 3(10) | -( -) |
| OSMORHIZA CHILENSIS | 37( 3) | 64( 5) | 50( 4) | 25( 6) | 50( 2) | 40( 3) | 23( 2) | -( -) | 33( T) | 23( 4) | 21( 2) |
| OSMORHIZA OCCIDENTALIS | 15( 3) | 9( 5) | 20( 3) | -( -) | 69( 7) | 24( 3) | 5( T) | -( -) | 8( T) | -( -) | -( -) |
| PEDICULARIS RACEMOSA | 1( 6) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| PENSTEMON PROCERUS | 1( 3) | -( -) | -( -) | -( -) | -( -) | -( -) | 3( 2) | -( -) | -( -) | -( -) | 1( 1) |
| PENSTEMON RYDBERGII | 2( 1) | -( -) | -( -) | -( -) | 6( T) | 5( 1) | 3( 1) | -( -) | -( -) | -( -) | 3( T) |
| PHACELIA HETEROPHYLLA | 12( 1) | 18( T) | 28( T) | -( -) | 13( T) | 24( 1) | 5( T) | 14( T) | 8( T) | 17( 1) | -( -) |
| POLEMONIUM FOLIOSISSIMUM | 16( 2) | 27( T) | 21( 1) | -( -) | 69( 2) | 30( 2) | 3( T) | -( -) | -( -) | -( -) | 1( T) |
| POLYGONUM DOUGLASII | 17( 3) | 18( 3) | 25( 1) | 8( T) | 44( 2) | 26( 4) | 7( 5) | -( -) | 8( 2) | -( -) | 10( T) |
| POTENTILLA DIVERSIFOLIA | 2( 1) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 7( T) | 4( T) |
| POTENTILLA GLANDULOSA | 8( 1) | -( -) | 6( T) | 8( T) | 13( T) | 9( 1) | 10( 1) | -( -) | 42( T) | 10( T) | 1( T) |
| POTENTILLA GRACILIS | 12( 1) | -( -) | 1( T) | 8( T) | -( -) | 6( T) | 11( 1) | 43( T) | 17( 1) | 3( T) | 51( 1) |
| PTERIDIUM AQUILINUM | 2(46) | 100(44) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| RANUNCULUS INAMOENUS | 4( T) | -( -) | 3( T) | -( -) | 19( T) | 1( T) | 5( T) | -( -) | -( -) | -( -) | 1( T) |
| RUDBECKIA OCCIDENTALIS | 33( 9) | 36( 6) | 38( 4) | 8( 2) | 38(14) | 67(10) | 7( T) | -( -) | 8( T) | 7( 2) | -( -) |
| SCROPHULARIA LANCEOLATA | 9( 1) | 36( T) | 18( T) | -( -) | 13( 3) | 15( 1) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SENECIO CYMBALARIOIDES | 10( 1) | -( -) | 21( 1) | 8( T) | -( -) | 15( 1) | 3( 1) | -( -) | 25( T) | 3( T) | 3( 3) |
| SENECIO INTEGERRIMUS | 2( 1) | -( -) | 1( 2) | -( -) | -( -) | 1( T) | 2( T) | -( -) | -( -) | 7( T) | 4( 1) |
| SENECIO SERRA | 24( 4) | 27( 9) | 45( 4) | -( -) | 31( 4) | 54( 5) | -( -) | -( -) | 8( T) | -( -) | 1( 2) |
| SENECIO VULGARIS | 3( 1) | -( -) | -( -) | -( -) | -( -) | 1( T) | 2( 5) | 14( T) | -( -) | 10( T) | -( -) |
| SIDALCEA OREGANA | 2( 1) | -( -) | 3( T) | -( -) | -( -) | 6( T) | -( -) | -( -) | 17( T) | -( -) | 1( T) |
| SILENE MENZIESII | 7( 1) | 18( T) | 12( 1) | 25( 1) | -( -) | 3( 1) | 2( 1) | -( -) | -( -) | 3( T) | 1( T) |
| SMILACINA RACEMOSA | 4( 1) | 27( T) | 9( 1) | 17( T) | -( -) | 3( T) | 2( T) | -( -) | -( -) | 3( T) | -( -) |
| SMILACINA STELLATA | 17( 3) | 45(17) | 28( 4) | 58(12) | 25( T) | 15( 1) | 23( 2) | 43( 1) | -( -) | 7( T) | 13( 1) |
| STELLARIA JAMESIANA | 36( 2) | 27( 1) | 41( 3) | 8( 2) | 56( 9) | 46( 2) | 21( 1) | 14( T) | 8( T) | 20( T) | 29( 2) |
| TARAXACUM OFFICINALE | 46( 3) | 27( T) | 31( T) | 33( T) | 25( T) | 28( 1) | 59( 3) | 72( 7) | 33( 2) | 70( 4) | 70( 7) |
| THALICTRUM FENDLERI | 49( 7) | 45( 2) | 68(12) | 42( 5) | 75(13) | 52( 8) | 41( 9) | 43( 3) | 33( 1) | 37( 3) | 44( 6) |
| THERMOPSIS MONTANA | 3( 5) | 9( T) | 1( 7) | 8( 7) | -( -) | -( -) | 3( 2) | -( -) | -( -) | 10( 5) | 4( 6) |
| TRAGOPOGON DUBIUS | 4( T) | -( -) | 7( T) | -( -) | -( -) | 5( T) | 2( T) | -( -) | 17( T) | 10( 1) | -( -) |
| TRIFOLIUM LONGIPES | 6( 8) | 9( T) | -( -) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | 3( 2) | 13( 7) |
| URTICA DIOICA | 2( 1) | 18( 5) | 2( 3) | -( -) | 13( T) | 2( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| VALERIANA OCCIDENTALIS | 24( 5) | 36( 3) | 32( 4) | -( -) | 56( 5) | 51( 6) | 2( T) | -( -) | -( -) | 7( 1) | -( -) |
| VERATRUM CALIFORNICUM | 1(10) | -( -) | 1( T) | -( -) | -( -) | 2( 2) | -( -) | -( -) | -( -) | -( -) | -( -) |
| VICIA AMERICANA | 28( 6) | 36( 2) | 38( 6) | 8(10) | 38( 2) | 38( 6) | 30(10) | 57( 5) | 17( T) | 33( 8) | 1( T) |
| VIGUIERA MULTIFLORA | 5( 2) | -( -) | 5( T) | -( -) | 6( T) | 12( 5) | 8( T) | -( -) | -( -) | 3( 3) | 1( T) |
| VIOLA ADUNCA | 12( 1) | 9( 2) | 16( 1) | 17( 1) | 13( T) | 11( 1) | 7( 4) | -( -) | 25( 4) | 13( 1) | 4( T) |
| VIOLA CANADENSIS | 3( 2) | -( -) | -( -) | -( -) | 13( 2) | 3( 3) | 8( 1) | -( -) | -( -) | -( -) | -( -) |
| VIOLA NUTTALLII | 9( 1) | 9( T) | 10( 2) | 8( T) | 31( 2) | 9( 1) | -( -) | -( -) | 8( T) | 3( 3) | 4( 2) |

# APPENDIX A. (Con.)

| | POTR/ JUCO/ SIHY C.T. | POTR/ JUCO/ ASMI C.T. | POTR/ VECA C.T. | POTR/ HELA C.T. | POTR/ PTAQ C.T. | POTR/ SESE C.T. | POTR/ CAGE C.T. | POTR/ FETH C.T. | POTR/ SIHY C.T. | POTR/ BRCA C.T. | POTR/ POPR C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 21 | 10 | 2 | 14 | 13 | 125 | 49 | 14 | 11 | 14 | 18 |
| TREES | | | | | | | | | | | |
| ABIES CONCOLOR | 5( T) | -( -) | -( -) | 7( T) | -( -) | 2( 4) | 4( T) | 14( T) | -( -) | 7( T) | 6( 1) |
| ABIES LASIOCARPA | -( -) | 10( T) | -( -) | 7( T) | 8( 1) | 30( 1) | 41( 1) | 36( 1) | 18( T) | 21( T) | 28( 1) |
| PICEA ENGELMANNII | 5( 2) | 10( T) | -( -) | -( -) | -( -) | 7( 1) | 20( 1) | 29( 3) | 18( T) | -( -) | -( -) |
| PICEA PUNGENS | 19( 3) | -( -) | -( -) | -( -) | -( -) | 2( T) | 2( T) | -( -) | -( -) | 7( T) | 11( 2) |
| PINUS CONTORTA | 19( 2) | 40( 3) | 50( T) | -( -) | -( -) | 1( 1) | 18( 2) | -( -) | 9( T) | 21( T) | -( -) |
| PINUS FLEXILIS | 5( 2) | 10( T) | -( -) | -( -) | 8( 2) | 1( T) | 8( 1) | -( -) | 9( T) | 14( 2) | 11( 1) |
| PINUS PONDEROSA | 14( 2) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( 1) | 7( T) | 55( 3) | -( -) | 11( 1) |
| POPULUS TREMULOIDES | 100(68) | 100(79) | 100(71) | 100(83) | 100(84) | 100(78) | 100(82) | 100(78) | 100(87) | 100(73) | 100(74) |
| PSEUDOTSUGA MENZIESII | 29( 2) | 20( T) | -( -) | -( -) | 8( 1) | 8( 2) | 14( T) | -( -) | 18( 1) | 14( T) | 6( 5) |
| SHRUBS | | | | | | | | | | | |
| ACER GLABRUM | -( -) | -( -) | -( -) | -( -) | 8( 2) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| ACER GRANDIDENTATUM | -( -) | -( -) | 50( T) | 7( T) | 23( 3) | 8( 2) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| AMELANCHIER ALNIFOLIA | 19( T) | 30( T) | -( -) | -( -) | 31( T) | 10( 1) | 16( 1) | -( -) | 9( T) | 7( 1) | 33( 1) |
| ARCTOSTAPHYLOS UVA-URSI | 19( 1) | 40(11) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| ARTEMISIA TRIDENTATA | 71( 9) | 50( 7) | -( -) | -( -) | -( -) | 4( 2) | 10( 1) | -( -) | 27( T) | -( -) | 6( T) |
| BERBERIS REPENS | 48( 8) | 70(12) | 50( T) | -( -) | 8(15) | 13( 3) | 45( 6) | -( -) | 36( 2) | 29( 3) | 61( 2) |
| CEANOTHUS VELUTINUS | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | 7( 3) | 6( T) |
| CHRYSOTHAMNUS VISCIDIFLORUS | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 6( T) | -( -) | -( -) | -( -) | -( -) |
| JUNIPERUS COMMUNIS | 67(14) | 100(17) | -( -) | -( -) | 8( T) | 1( T) | 41( 1) | -( -) | 45( 2) | 21( 2) | 33( 2) |
| PACHISTIMA MYRSINITES | -( -) | 10( T) | -( -) | -( -) | -( -) | 4( 2) | 10( 1) | -( -) | -( -) | 7( 4) | -( -) |
| PHYSOCARPUS MALVACEUS | -( -) | -( -) | -( -) | -( -) | -( -) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| PRUNUS VIRGINIANA | -( -) | -( -) | -( -) | 7( T) | 8( T) | 9( 2) | 2( 2) | -( -) | -( -) | 7( T) | 17( T) |
| QUERCUS GAMBELII | 5( T) | -( -) | -( -) | -( -) | -( -) | 1( 2) | 2( T) | -( -) | -( -) | -( -) | 17( 1) |
| RIBES LACUSTRE | -( -) | -( -) | -( -) | -( -) | -( -) | 2( 2) | -( -) | 7( 2) | -( -) | 14( 2) | -( -) |
| RIBES MONTIGENUM | -( -) | -( -) | -( -) | -( -) | -( -) | 8( 2) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| RIBES SP. | -( -) | -( -) | 50( T) | 7( T) | -( -) | 6( 1) | 12( T) | -( -) | -( -) | -( -) | 22( T) |
| ROSA WOODSII | 33( 1) | 60( 3) | 50( T) | 14( 3) | 8( T) | 12( 1) | 51( T) | 36( 1) | 27( T) | 14( T) | 44( 2) |
| RUBUS PARVIFLORUS | -( -) | -( -) | -( -) | -( -) | 8( 2) | 2( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SALIX SCOULERIANA | -( -) | -( -) | -( -) | 7( 3) | 8( 5) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SAMBUCUS RACEMOSA | -( -) | -( -) | -( -) | 57( 1) | 46( 1) | 35( 1) | 2( T) | -( -) | -( -) | 14( 3) | 6( T) |
| SHEPHERDIA CANADENSIS | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | 2( T) | -( -) | -( -) | -( -) | 6( 1) |
| SORBUS SCOPULINA | -( -) | -( -) | -( -) | -( -) | -( -) | 2( 2) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SYMPHORICARPOS OREOPHILUS | 62(19) | 70( 7) | 50( T) | 64( 3) | 54( 4) | 59( 2) | 69( 3) | 79( 2) | 45( 1) | 64( 2) | 78( 3) |
| VACCINIUM CAESPITOSUM | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| VACCINIUM SCOPARIUM | -( -) | -( -) | -( -) | -( -) | -( -) | 1( T) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| GRAMINOIDS | | | | | | | | | | | |
| AGROPYRON TRACHYCAULUM | 38( 3) | 70( 6) | 100( 5) | 36( 2) | 23( 3) | 67( 5) | 61( 6) | 57( 1) | 18( 1) | 64(13) | 56( 6) |
| ARRHENATHERUM ELATIUS | -( -) | -( -) | 50( T) | -( -) | -( -) | 1( 1) | -( -) | 7(20) | -( -) | -( -) | -( -) |
| BROMUS ANOMALUS | 33( 4) | -( -) | -( -) | -( -) | -( -) | 2( 1) | 12( 3) | 21( 4) | 9(10) | -( -) | 6( 5) |
| BROMUS CARINATUS | 10( 3) | -( -) | 50( 4) | 86(12) | 69( 6) | 82(16) | 27( 5) | 21(20) | -( -) | 100(31) | 44( 2) |
| BROMUS CILIATUS | -( -) | 60( 2) | -( -) | 7( 3) | 8( 4) | 5( 2) | 27( 2) | 14( 3) | 18( 5) | -( -) | 6(10) |
| CALAMAGROSTIS RUBESCENS | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 4) | 2(75) | -( -) | -( -) | -( -) | 6( 2) |
| CAREX GEYERI | -( -) | 20( 1) | -( -) | -( -) | -( -) | 6( 3) | 51(22) | 7( T) | 9( T) | 14( 1) | 6( T) |
| CAREX HOODII | -( -) | -( -) | 50( 7) | 21( 1) | 8( T) | 24( 3) | 6( 5) | 7( T) | -( -) | 7( T) | -( -) |
| CAREX OBTUSATA | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 8(14) | 21( 7) | 9( 1) | -( -) | -( -) |
| CAREX ROSSII | 19( 1) | -( -) | -( -) | -( -) | 15( 2) | 3( 1) | 31(10) | 14( 2) | 9( 4) | 7( 1) | 11( T) |
| DACTYLIS GLOMERATA | -( -) | -( -) | 50( 3) | -( -) | -( -) | 8( 2) | 2( T) | -( -) | -( -) | 21( 3) | 22(22) |
| ELYMUS CINEREUS | -( -) | -( -) | -( -) | -( -) | -( -) | 2( 1) | -( -) | -( -) | -( -) | -( -) | -( -) |
| ELYMUS GLAUCUS | -( -) | 10( T) | -( -) | 50( 6) | 69(11) | 46(17) | 18( 5) | -( -) | -( -) | 36(14) | 11( 4) |
| FESTUCA IDAHOENSIS | 10( 8) | -( -) | -( -) | -( -) | -( -) | 2( 1) | 6( 3) | 7( T) | 9( T) | 7( 2) | 11( T) |
| FESTUCA THURBERI | 5( T) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | 100(18) | 9( T) | -( -) | -( -) |
| KOELERIA CRISTATA | 19( 1) | 10(10) | -( -) | -( -) | -( -) | 2(10) | 4( T) | -( -) | 9( T) | -( -) | -( -) |
| LEUCOPOA KINGII | 14( 4) | 60( 6) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| MELICA SPECTABILIS | -( -) | -( -) | -( -) | 7( 2) | 8( T) | 19( 1) | 14( 2) | -( -) | -( -) | 21( 2) | 22( 1) |
| PHLEUM ALPINUM | -( -) | -( -) | 50( 5) | -( -) | -( -) | 5( 2) | 4( 1) | -( -) | -( -) | 7( 5) | -( -) |
| POA FENDLERIANA | 24(14) | -( -) | -( -) | -( -) | -( -) | -( -) | 27( 1) | 21( 1) | 73( 6) | -( -) | 11( 2) |
| POA NERVOSA | 5( 1) | -( -) | -( -) | 21( 2) | 23( 1) | 37( 1) | 14( 3) | -( -) | -( -) | 21( T) | 6(10) |
| POA PRATENSIS | 29( 4) | -( -) | 50( 3) | 7( 4) | 23( 3) | 26(17) | 35( 9) | 43( 5) | 9( T) | 43( 9) | 100(37) |
| SITANION HYSTRIX | 48( 4) | -( -) | -( -) | -( -) | -( -) | -( -) | 20( 1) | 36( 1) | 91(10) | -( -) | 6( T) |
| STIPA COMATA | 57(12) | 10( T) | -( -) | -( -) | -( -) | -( -) | 4( T) | 21( 1) | 73(17) | -( -) | 6( 3) |
| STIPA LETTERMANII | 43( 6) | -( -) | -( -) | -( -) | -( -) | 5( 1) | 20( 4) | 7( 7) | 9( 4) | 7( 1) | 11( T) |
| STIPA OCCIDENTALIS | 19( 1) | 20( T) | -( -) | -( -) | 8( T) | 19( 3) | 53(19) | 71( 2) | 9( 5) | 14( T) | 17( T) |
| TRISETUM SPICATUM | -( -) | -( -) | -( -) | 7( 1) | -( -) | 7( T) | 27( 1) | 29( T) | 9( T) | 21( T) | 6( T) |

| | POTR/ JUCO/ SIHY C.T. | POTR/ JUCO/ ASMI C.T. | POTR/ VECA C.T. | POTR/ HELA C.T. | POTR/ PTAQ C.T. | POTR/ SESE C.T. | POTR/ CAGE C.T. | POTR/ FETH C.T. | POTR/ SIHY C.T. | POTR/ BRCA C.T. | POTR/ POPR C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 21 | 10 | 2 | 14 | 13 | 125 | 49 | 14 | 11 | 14 | 18 |
| FORBS | | | | | | | | | | | |
| ACHILLEA MILLEFOLIUM | 52( 2) | 90( 2) | 100( T) | 7( 3) | 15( 2) | 57( 2) | 59( 2) | 64( 3) | 9( 3) | 64( 2) | 72( 2) |
| ACTAEA RUBRA | -( -) | -( -) | -( -) | 29( 5) | 31( 9) | 5( 1) | -( -) | -( -) | -( -) | -( -) | -( -) |
| AGASTACHE URTICIFOLIA | -( -) | -( -) | -( -) | 57( 2) | 62( 7) | 42( 4) | 2( T) | 7( T) | -( -) | 14( T) | 6( T) |
| AGOSERIS GLAUCA | 5( T) | 30( T) | -( -) | 7( T) | -( -) | 4( T) | 8( T) | 7( T) | 18( T) | 7( T) | 6( T) |
| ALLIUM BREVISTYLUM | -( -) | 10( T) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| ALLIUM CERNUUM | 14( T) | 20( 1) | -( -) | -( -) | -( -) | -( -) | 2( 1) | -( -) | 9( T) | -( -) | -( -) |
| ANTENNARIA MICROPHYLLA | 38( 5) | 60( 2) | -( -) | 7( 7) | -( -) | 1( T) | 20( 1) | 21( T) | 64( 3) | -( -) | -( -) |
| ANTENNARIA PARVIFOLIA | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| APOCYNUM ANDROSAEMIFOLIUM | 5( T) | -( -) | -( -) | -( -) | -( -) | 1( T) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| AQUILEGIA COERULEA | 5( T) | 20( T) | -( -) | 7( 3) | 8( T) | 18( T) | 16( 1) | 14( T) | -( -) | 29( T) | -( -) |
| ARENARIA CONGESTA | 10( 1) | 10( T) | -( -) | -( -) | -( -) | 1( 2) | -( -) | -( -) | 9( T) | -( -) | -( -) |
| ARNICA CORDIFOLIA | -( -) | 10( T) | -( -) | -( -) | -( -) | 3( 1) | 6( 1) | -( -) | 9( 1) | -( -) | -( -) |
| ARNICA LATIFOLIA | -( -) | 30( 4) | -( -) | -( -) | -( -) | 1( T) | 4( 5) | -( -) | -( -) | -( -) | 6( T) |
| ARTEMISIA LUDOVICIANA | -( -) | -( -) | -( -) | -( -) | -( -) | 4( 2) | -( -) | -( -) | -( -) | -( -) | -( -) |
| ASTER CHILENSIS | 5( 2) | -( -) | -( -) | -( -) | -( -) | 3( T) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| ASTER ENGELMANNII | -( -) | -( -) | -( -) | 50( 3) | 54( 1) | 22( 3) | 2( T) | -( -) | -( -) | -( -) | 6( T) |
| ASTER FOLIACEUS | -( -) | -( -) | 100( T) | 7( 3) | -( -) | 6( 6) | -( -) | -( -) | -( -) | -( -) | 11( 3) |
| ASTER OCCIDENTALIS | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | 14( 4) | -( -) |
| ASTRAGALUS MISER | 19( 5) | 100(18) | -( -) | -( -) | -( -) | 2( 1) | 31(17) | -( -) | 18( 4) | -( -) | 22( 2) |
| CAMPANULA ROTUNDIFOLIA | 5( T) | 10( T) | -( -) | -( -) | -( -) | -( -) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| CASTILLEJA MINIATA | 10( T) | 20( T) | -( -) | 7( T) | 8( T) | 7( 1) | 12( T) | 7( T) | 9( 2) | 14( T) | -( -) |
| CHENOPODIUM FREMONTII | 5( T) | -( -) | -( -) | 21( 2) | 8( 3) | 11( 3) | 2( T) | 7( T) | 9( T) | 14( T) | -( -) |
| CHLOROCRAMBE HASTATA | -( -) | -( -) | -( -) | 14( T) | 31( 4) | 2( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| CIRCAEA ALPINA | -( -) | -( -) | -( -) | 7( T) | 15(25) | 2( 5) | -( -) | -( -) | -( -) | -( -) | -( -) |
| CIRSIUM ARVENSE | 19( T) | -( -) | -( -) | -( -) | 8( T) | 1( T) | 2( T) | 7( T) | 9( T) | 7( T) | 6( T) |
| CIRSIUM VULGARE | -( -) | -( -) | 50( T) | -( -) | -( -) | 1( T) | 4( T) | -( -) | -( -) | -( -) | 6( T) |
| CLEMATIS COLUMBIANA | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| COLLINSIA PARVIFLORA | -( -) | -( -) | -( -) | -( -) | 15( 4) | 19( 8) | 6( T) | -( -) | -( -) | 7( T) | 17( 1) |
| COLLOMIA LINEARIS | -( -) | -( -) | -( -) | 7( T) | 15( T) | 33( 5) | 4( 2) | 7( T) | -( -) | 21( 1) | 6( 2) |
| CORALLORHIZA MACULATA | -( -) | -( -) | -( -) | -( -) | -( -) | 1( T) | 4( T) | 21( T) | 9( T) | 7( T) | 6( T) |
| DELPHINIUM NUTTALLIANUM | 5( T) | 10( T) | -( -) | -( -) | 15( T) | 11( T) | 6( T) | -( -) | -( -) | -( -) | 22( 1) |
| DELPHINIUM OCCIDENTALE | -( -) | -( -) | -( -) | 43( 2) | 31( T) | 33( 4) | -( -) | 7( T) | -( -) | 14( T) | 6( T) |
| DESCURAINIA CALIFORNICA | -( -) | -( -) | -( -) | -( -) | 8( T) | 9( 2) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| DESCURAINIA RICHARDSONII | -( -) | -( -) | -( -) | 57( 3) | 62( 1) | 53( 1) | 14( 1) | 29( 1) | 9( T) | 29( 1) | 11( T) |
| EPILOBIUM ANGUSTIFOLIUM | -( -) | -( -) | -( -) | -( -) | -( -) | 5( T) | 4( T) | 7( T) | -( -) | -( -) | 6( 1) |
| ERIGERON FLAGELLARIS | -( -) | -( -) | -( -) | -( -) | 8( 1) | -( -) | 6( 1) | -( -) | -( -) | -( -) | -( -) |
| ERIGERON PEREGRINUS | 5( T) | 40( T) | -( -) | -( -) | -( -) | -( -) | 2( 3) | -( -) | -( -) | 7( 1) | -( -) |
| ERIGERON SPECIOSUS | 10( 1) | 10( T) | 100( T) | -( -) | 8( 1) | 14( 1) | 12( 3) | -( -) | 9( 1) | 7( T) | 22( 1) |
| ERIGERON URSINUS | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 3) | -( -) | -( -) | -( -) | -( -) | 6( T) |
| ERYTHRONIUM GRANDIFLORUM | -( -) | -( -) | -( -) | -( -) | -( -) | 3( 1) | 4( 3) | -( -) | -( -) | -( -) | -( -) |
| FRAGARIA VESCA | 10( 3) | 10( 5) | -( -) | 7( 5) | 8( T) | 10( 4) | 29( 2) | 14( 1) | -( -) | 7( T) | 33( T) |
| FRASERA SPECIOSA | 14( 1) | 10( T) | -( -) | -( -) | -( -) | 6( 2) | 18( 2) | -( -) | -( -) | -( -) | 6( 3) |
| GALIUM APARINE | -( -) | -( -) | 50( T) | -( -) | -( -) | -( -) | 2( 4) | -( -) | -( -) | -( -) | -( -) |
| GALIUM BIFOLIUM | -( -) | -( -) | -( -) | 50( 1) | 31(10) | 27( 5) | 6(13) | -( -) | 9( T) | -( -) | 11( T) |
| GALIUM BOREALE | 10( T) | 50( 2) | 50( T) | 7( T) | 23( 3) | 10( 3) | 22( 1) | -( -) | -( -) | 14( T) | 17( 2) |
| GERANIUM RICHARDSONII | -( -) | -( -) | -( -) | 21( T) | 15( 3) | 10( 5) | 4( 2) | -( -) | -( -) | -( -) | 6( T) |
| GERANIUM VISCOSISSIMUM | 38( 1) | 70( T) | -( -) | 14(14) | -( -) | 24( 4) | 41( 6) | 7( T) | -( -) | 14( T) | 39( 1) |
| HABENARIA UNALASCENSIS | -( -) | 10( T) | -( -) | -( -) | -( -) | 1( T) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| HACKELIA FLORIBUNDA | 5( T) | -( -) | -( -) | 14( 5) | 54( 1) | 42( 3) | 16( 4) | -( -) | -( -) | 36( 2) | 6( T) |
| HAPLOPAPPUS PARRYI | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | 6( 1) | 14( T) | -( -) | -( -) | -( -) |
| HELENIUM HOOPESII | -( -) | -( -) | 50( T) | 7( 3) | -( -) | 7( 2) | 10( 2) | 29( T) | 9( T) | 21( 4) | 17( 4) |
| HELIANTHELLA UNIFLORA | -( -) | -( -) | -( -) | -( -) | -( -) | 2(22) | -( -) | -( -) | -( -) | -( -) | -( -) |
| HERACLEUM LANATUM | -( -) | -( -) | -( -) | 100(20) | 23( 3) | 6( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| HIERACIUM ALBIFLORUM | -( -) | -( -) | -( -) | -( -) | -( -) | 1( T) | 2( T) | -( -) | -( -) | 7( T) | -( -) |
| HYDROPHYLLUM CAPITATUM | -( -) | -( -) | -( -) | 7( T) | 15( 1) | 19( 1) | -( -) | -( -) | -( -) | -( -) | 11( T) |
| HYDROPHYLLUM FENDLERI | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( 2) | -( -) | -( -) | -( -) | -( -) |
| IRIS MISSOURIENSIS | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 4( 5) | -( -) | -( -) | -( -) | 28(10) |
| LATHYRUS ARIZONICUS | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 14(38) | -( -) | -( -) | -( -) |
| LATHYRUS LANSZWERTII | 5( T) | -( -) | -( -) | 43(13) | 31(18) | 44(13) | 27(28) | 36(41) | 9( 4) | 57(21) | -( -) |
| LATHYRUS LEUCANTHUS | -( -) | -( -) | -( -) | 21(10) | 8(10) | 14(14) | 14(21) | 36(36) | -( -) | 14(17) | 11( 4) |
| LATHYRUS PAUCIFLORUS | -( -) | -( -) | -( -) | -( -) | -( -) | 10( 1) | -( -) | -( -) | -( -) | -( -) | -( -) |
| LIGUSTICUM FILICINUM | -( -) | -( -) | -( -) | -( -) | -( -) | 5(11) | 4( 3) | -( -) | -( -) | -( -) | -( -) |
| LIGUSTICUM PORTERI | 5( T) | -( -) | -( -) | 7( T) | -( -) | 2( 1) | 27( 1) | 14( 1) | -( -) | 14( 3) | 11( 1) |
| LUPINUS ARGENTEUS | 48(21) | 40( 2) | -( -) | -( -) | -( -) | 9( 4) | 24(13) | 7( T) | 36(19) | 7(25) | 28( 5) |
| LUPINUS CAUDATUS | 5(30) | -( -) | -( -) | -( -) | -( -) | 1(10) | 2( 1) | -( -) | -( -) | -( -) | -( -) |

| | POTR/ JUCO/ SIHY C.T. | POTR/ JUCO/ ASMI C.T. | POTR/ VECA C.T. | POTR/ HELA C.T. | POTR/ PTAQ C.T. | POTR/ SESE C.T. | POTR/ CAGE C.T. | POTR/ FETH C.T. | POTR/ SIHY C.T. | POTR/ BRCA C.T. | POTR/ POPR C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 21 | 10 | 2 | 14 | 13 | 125 | 49 | 14 | 11 | 14 | 18 |
| FORBS (CONT'D) | | | | | | | | | | | |
| MERTENSIA ARIZONICA | -( -) | -( -) | -( -) | 43( 5) | 15( 1) | 43(14) | 4( T) | 7( T) | -( -) | 7( T) | 11( T) |
| MERTENSIA CILIATA | -( -) | -( -) | -( -) | -( -) | -( -) | 2(25) | -( -) | -( -) | -( -) | -( -) | -( -) |
| MERTENSIA FRANCISCANA | -( -) | -( -) | -( -) | 7(10) | -( -) | 1(20) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| MERTENSIA LONGIFLORA | -( -) | -( -) | -( -) | -( -) | -( -) | 2(17) | -( -) | -( -) | -( -) | -( -) | -( -) |
| NEMOPHILA BREVIFLORA | -( -) | -( -) | -( -) | 43(21) | 46( 5) | 42(21) | 2(20) | -( -) | -( -) | 7(15) | -( -) |
| OSMORHIZA CHILENSIS | -( -) | -( -) | 50( T) | 36( 6) | 46( 4) | 43( 3) | 22( 3) | 21( 2) | -( -) | 29( 2) | 44( 3) |
| OSMORHIZA OCCIDENTALIS | -( -) | -( -) | -( -) | 29( 2) | -( -) | 37( 3) | 2( T) | -( -) | -( -) | 14( T) | 11( T) |
| PEDICULARIS RACEMOSA | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| PENSTEMON PROCERUS | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | 2(20) | 7( T) | -( -) | 7( T) | -( -) |
| PENSTEMON RYDBERGII | -( -) | -( -) | -( -) | -( -) | -( -) | 6( 2) | 6( 1) | -( -) | -( -) | -( -) | 6( T) |
| PHACELIA HETEROPHYLLA | -( -) | -( -) | -( -) | 21( 5) | 31( 1) | 16( 3) | 6( T) | -( -) | 9( T) | 7( T) | -( -) |
| POLEMONIUM FOLIOSISSIMUM | -( -) | -( -) | -( -) | 57( 6) | 38( 1) | 37( 3) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| POLYGONUM DOUGLASII | 10( T) | -( -) | -( -) | 14( T) | 23( T) | 36( 6) | 10( T) | 7( T) | 18( T) | 36( 3) | 6( T) |
| POTENTILLA DIVERSIFOLIA | 14( 7) | -( -) | -( -) | -( -) | -( -) | -( -) | 2( T) | 7( T) | 9( 2) | -( -) | -( -) |
| POTENTILLA GLANDULOSA | 5( T) | -( -) | -( -) | -( -) | 8( T) | 9( 1) | 6( T) | 29( T) | 18( T) | -( -) | -( -) |
| POTENTILLA GRACILIS | -( -) | 30( T) | -( -) | 7( T) | -( -) | 7( 1) | 27( 1) | 43( T) | 18( T) | 21( T) | 11( 1) |
| PTERIDIUM AQUILINUM | -( -) | -( -) | -( -) | 7( T) | 100(51) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| RANUNCULUS INAMOENUS | -( -) | -( -) | -( -) | 7( T) | -( -) | 5( T) | 16( T) | 7( T) | -( -) | 21( 1) | 11( T) |
| RUDBECKIA OCCIDENTALIS | -( -) | -( -) | 100( 3) | 93(14) | 92( 8) | 70(15) | 6(20) | -( -) | -( -) | 43( 8) | 28( 1) |
| SCROPHULARIA LANCEOLATA | -( -) | -( -) | -( -) | 50( 1) | 38( 1) | 22( 2) | 2( T) | -( -) | -( -) | 7( T) | -( -) |
| SENECIO CYMBALARIOIDES | -( -) | 30( T) | -( -) | 7( T) | 8( T) | 16( 1) | 14( 1) | -( -) | -( -) | 14( T) | -( -) |
| SENECIO INTEGERRIMUS | 5( T) | -( -) | -( -) | -( -) | -( -) | 2( 2) | 4( T) | -( -) | 9( T) | -( -) | 6( T) |
| SENECIO SERRA | -( -) | -( -) | -( -) | 71( 5) | 46( 4) | 50( 4) | -( -) | -( -) | -( -) | -( -) | -( -) |
| SENECIO VULGARIS | 5( T) | -( -) | -( -) | -( -) | -( -) | 1( T) | 4( T) | 29( T) | 9( T) | -( -) | 6( T) |
| SIDALCEA OREGANA | -( -) | -( -) | 50( 3) | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | -( -) | 11( T) |
| SILENE MENZIESII | 10( T) | -( -) | -( -) | 7( T) | 8( T) | 6( 1) | 4( 2) | 7( T) | -( -) | 7( T) | -( -) |
| SMILACINA RACEMOSA | -( -) | -( -) | -( -) | 7( T) | 8( T) | 3( 4) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| SMILACINA STELLATA | 10( T) | 50( T) | 50( 3) | 36( 3) | 46(12) | 8( 3) | 24( 2) | 14( T) | -( -) | 14( 2) | 22( 1) |
| STELLARIA JAMESIANA | -( -) | 10( 2) | 50( T) | 36( 2) | 38( 2) | 73( 4) | 18( 5) | 21( 5) | -( -) | 50( 1) | 22( 2) |
| TARAXACUM OFFICINALE | 71( 5) | 70( 3) | 50(10) | 14( 2) | 8( T) | 28( 3) | 57( 5) | 79( 8) | 91( 2) | 50(17) | 89( 5) |
| THALICTRUM FENDLERI | 10( 5) | 50( 3) | -( -) | 50(21) | 46( 4) | 55( 7) | 31( 3) | -( -) | 9( T) | 64( 6) | 39( 1) |
| THERMOPSIS MONTANA | -( -) | 10(25) | -( -) | -( -) | -( -) | -( -) | 6( 3) | -( -) | -( -) | 7( T) | 22( 1) |
| TRAGOPOGON DUBIUS | 10( T) | -( -) | 50( T) | -( -) | 8( T) | 6( T) | 4( T) | -( -) | 9( T) | 7( T) | -( -) |
| TRIFOLIUM LONGIPES | 5(10) | 10( 3) | 50(10) | -( -) | -( -) | 5( 9) | 10( 8) | 7( T) | 9( T) | -( -) | 22( 3) |
| URTICA DIOICA | -( -) | -( -) | -( -) | 21( T) | 23( 2) | 6( 1) | -( -) | -( -) | -( -) | -( -) | 6( T) |
| VALERIANA OCCIDENTALIS | -( -) | -( -) | 50( T) | 71(11) | 31( 3) | 55( 5) | -( -) | -( -) | -( -) | -( -) | 6( T) |
| VERATRUM CALIFORNICUM | -( -) | -( -) | 100(42) | -( -) | -( -) | 2( 3) | 2( T) | -( -) | -( -) | -( -) | -( -) |
| VICIA AMERICANA | -( -) | -( -) | 50( 3) | 50( 5) | 15( 1) | 41( 7) | 16( 1) | 71( 7) | 9( 1) | 50( 2) | 39( 6) |
| VIGUIERA MULTIFLORA | -( -) | 10( 5) | -( -) | -( -) | 8( T) | 6( 1) | 2( T) | -( -) | -( -) | 21( T) | -( -) |
| VIOLA ADUNCA | -( -) | -( -) | -( -) | -( -) | -( -) | 12( 1) | 14( 2) | -( -) | -( -) | 14( T) | 33( 1) |
| VIOLA CANADENSIS | -( -) | -( -) | -( -) | -( -) | -( -) | 2( 1) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| VIOLA NUTTALLII | -( -) | -( -) | -( -) | -( -) | 15( T) | 18( 2) | 2( T) | -( -) | -( -) | 29( 1) | 11( 1) |

# APPENDIX A. (Con.)

| | POTR-ABLA/VACA C.T. | POTR-ABLA/AMAL C.T. | POTR-ABLA/SYOR/SESE C.T. | POTR-ABLA/SYOR/CAGE C.T. | POTR-ABLA/JUCO C.T. | POTR-ABLA/SESE C.T. | POTR-ABLA/CAGE C.T. | POTR-ABCO/SYOR C.T. | POTR-ABCO/JUCO C.T. | POTR-PSME/AMAL C.T. | POTR-PSME/JUCO C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 4 | 13 | 48 | 14 | 34 | 94 | 77 | 27 | 20 | 10 | 8 |
| TREES | | | | | | | | | | | |
| ABIES CONCOLOR | -( -) | 8(10) | 4( 3) | 7( T) | 3(10) | 2( 6) | 3(20) | 96(20) | 75(19) | 20( 1) | -( -) |
| ABIES LASIOCARPA | 100(29) | 100(18) | 98(13) | 86(20) | 88(16) | 100(18) | 92(24) | 7( 1) | 10( T) | 40( 2) | 25( 1) |
| PICEA ENGELMANNII | 25( T) | 31(10) | 13( 5) | 36(14) | 50( 7) | 24( 6) | 57(13) | -( -) | -( -) | -( -) | 13( T) |
| PICEA PUNGENS | -( -) | -( -) | 2(10) | 21( 3) | 15(12) | 1( 3) | 5( 9) | 11(16) | 55(20) | -( -) | 13( 5) |
| PINUS CONTORTA | 100(17) | 8( 8) | 4( 2) | 14( 7) | 15( 7) | 5(12) | 8( 8) | -( -) | -( -) | -( -) | 38(13) |
| PINUS FLEXILIS | -( -) | -( -) | -( -) | 14( T) | 41( 3) | 1( T) | 17( 2) | 4( T) | 30( 4) | -( -) | 13( 5) |
| PINUS PONDEROSA | -( -) | -( -) | -( -) | -( -) | 15( 3) | -( -) | 4( T) | -( -) | 15( 2) | -( -) | 13(25) |
| POPULUS TREMULOIDES | 100(47) | 100(67) | 100(67) | 100(74) | 100(67) | 100(68) | 100(63) | 100(60) | 100(65) | 100(66) | 100(59) |
| PSEUDOTSUGA MENZIESII | -( -) | 31( 3) | 25( 1) | 36( 4) | 44( 4) | 9( 5) | 13( 4) | 22( 7) | 75( 8) | 100(18) | 100(18) |
| SHRUBS | | | | | | | | | | | |
| ACER GLABRUM | -( -) | -( -) | 2( T) | -( -) | -( -) | 1( T) | -( -) | -( -) | -( -) | 10( 3) | -( -) |
| ACER GRANDIDENTATUM | -( -) | 38( 4) | -( -) | -( -) | -( -) | 4( 1) | -( -) | 15( 1) | -( -) | 40(35) | -( -) |
| AMELANCHIER ALNIFOLIA | -( -) | 92( 9) | 15( 1) | 14( 6) | 15( 2) | 14( 1) | 8( T) | 26( 1) | 20( T) | 90(20) | 25( 3) |
| ARCTOSTAPHYLOS UVA-URSI | -( -) | -( -) | -( -) | -( -) | 3( T) | -( -) | -( -) | 4( T) | 10( T) | -( -) | 13( T) |
| ARTEMISIA TRIDENTATA | -( -) | 8( 1) | 6( 1) | -( -) | 3( T) | 4( T) | 1( 1) | -( -) | 10( 4) | 10( T) | 38( 1) |
| BERBERIS REPENS | 50( 1) | 69( 4) | 25( 3) | 50( 3) | 56( 2) | 17( 1) | 30( 3) | 48( 8) | 55( 9) | 70(15) | 88( 8) |
| CEANOTHUS VELUTINUS | -( -) | 8( T) | -( -) | -( -) | -( -) | 1( T) | -( -) | -( -) | -( -) | -( -) | -( -) |
| CHRYSOTHAMNUS VISCIDIFLORUS | -( -) | 8( 1) | -( -) | -( -) | 9( 1) | -( -) | 1( T) | -( -) | 15( 1) | -( -) | -( -) |
| JUNIPERUS COMMUNIS | -( -) | -( -) | 6( 2) | 21( 1) | 100(12) | -( -) | 31( 1) | 7( 3) | 100(11) | -( -) | 100(18) |
| PACHISTIMA MYRSINITES | 50( 5) | 69(17) | 15( 2) | 7( T) | 9( 3) | 14( 1) | 8( 1) | 26( 1) | -( -) | 70( 2) | 13( 5) |
| PHYSOCARPUS MALVACEUS | -( -) | 23(23) | 4(38) | -( -) | -( -) | -( -) | -( -) | 4( T) | -( -) | 40( 1) | -( -) |
| PRUNUS VIRGINIANA | -( -) | 54(14) | 13( 1) | -( -) | 6( T) | 6( 1) | 1( T) | 11( T) | -( -) | 40( 5) | -( -) |
| QUERCUS GAMBELII | -( -) | 15(15) | -( -) | 7( 3) | -( -) | -( -) | -( -) | 4( 5) | -( -) | 20( 1) | -( -) |
| RIBES LACUSTRE | -( -) | 8( 3) | -( -) | 7( T) | -( -) | 1( T) | 1( T) | -( -) | -( -) | -( -) | -( -) |
| RIBES MONTIGENUM | -( -) | -( -) | 6( T) | -( -) | 3( 2) | 16( 3) | 6( T) | 4( T) | -( -) | -( -) | -( -) |
| RIBES SP. | 25( T) | -( -) | 8( T) | -( -) | 9( 2) | 12( 1) | 3( T) | -( -) | -( -) | 30( 1) | -( -) |
| ROSA WOODSII | 50( 2) | 62( 2) | 31( 1) | 57( 3) | 53( T) | 16( T) | 18( T) | 59( 1) | 20( T) | 90( T) | 63( T) |
| RUBUS PARVIFLORUS | 50( 1) | -( -) | 8(23) | -( -) | -( -) | 5( 1) | -( -) | -( -) | -( -) | 10( 3) | 13( T) |
| SALIX SCOULERIANA | -( -) | 8( T) | 6( 1) | -( -) | -( -) | 6( 1) | -( -) | -( -) | -( -) | 60( 2) | -( -) |
| SAMBUCUS RACEMOSA | -( -) | 8( T) | 21( 2) | -( -) | -( -) | 23( 2) | 1( T) | 7( T) | -( -) | -( -) | -( -) |
| SHEPHERDIA CANADENSIS | 25( T) | 23( 7) | 6( 1) | -( -) | 6( T) | 3( 1) | 3( 1) | -( -) | -( -) | 10( 4) | 13( 1) |
| SORBUS SCOPULINA | -( -) | 31( 2) | 13( 1) | -( -) | -( -) | 1( T) | -( -) | -( -) | -( -) | 30( 2) | -( -) |
| SYMPHORICARPOS OREOPHILUS | -( -) | 100(25) | 96(32) | 100(33) | 53( 4) | 57( 2) | 31( 1) | 100(27) | 70( 3) | 100(21) | 88(11) |
| VACCINIUM CAESPITOSUM | 75(15) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| VACCINIUM SCOPARIUM | 75( 9) | -( -) | 2( T) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| GRAMINOIDS | | | | | | | | | | | |
| AGROPYRON TRACHYCAULUM | 75( 3) | 46( 5) | 65( 7) | 57( 9) | 41( 3) | 57( 5) | 38( 4) | 48( 1) | 50( 2) | 40( 6) | 63( 3) |
| ARRHENATHERUM ELATIUS | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 3) | -( -) | 11(10) | -( -) | -( -) | -( -) |
| BROMUS ANOMALUS | -( -) | -( -) | -( -) | 14( 5) | 41( 4) | 5(11) | 22( 5) | 15( 4) | 50( 5) | -( -) | 13( 3) |
| BROMUS CARINATUS | -( -) | 31( 2) | 67( 9) | 36( 1) | 9( 4) | 64(11) | 13( 1) | 48( 3) | 15( 2) | 40(24) | 13( T) |
| BROMUS CILIATUS | -( -) | 23( T) | 8( 1) | 14( 4) | 35( 1) | 12( 4) | 16( 5) | 11( 3) | 5( 1) | -( -) | 38( 1) |
| CALAMAGROSTIS RUBESCENS | -( -) | -( -) | -( -) | -( -) | -( -) | 1(38) | 1( T) | -( -) | -( -) | 10( T) | -( -) |
| CAREX GEYERI | 25(10) | 31(11) | 17( 6) | 71(17) | 15(22) | 10(10) | 14(13) | 11( 1) | 10( 4) | 20(34) | 38(12) |
| CAREX HOODII | -( -) | 8( T) | 35( 3) | 7( 7) | 3( T) | 33( 4) | 3(13) | 7( 2) | -( -) | 10(10) | -( -) |
| CAREX OBTUSATA | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | 4(13) | -( -) | -( -) | -( -) | -( -) |
| CAREX ROSSII | -( -) | 15( T) | 6( T) | 29(10) | 56( 6) | 15( 1) | 69( 3) | -( -) | 30( 2) | -( -) | 25( 8) |
| DACTYLIS GLOMERATA | -( -) | -( -) | 6( 2) | -( -) | -( -) | 6( T) | 4( T) | 33( 7) | 5( T) | -( -) | -( -) |
| ELYMUS CINEREUS | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| ELYMUS GLAUCUS | 25( 2) | 69( 3) | 50( 5) | 14( 2) | 12(14) | 39(12) | 3( T) | 37(10) | -( -) | 70(12) | -( -) |
| FESTUCA IDAHOENSIS | -( -) | -( -) | 2( 2) | 7( T) | 3( 3) | -( -) | 1( 1) | -( -) | 5( T) | -( -) | 13( T) |
| FESTUCA THURBERI | -( -) | 8(17) | 2( T) | 29( 5) | -( -) | 2(10) | 10( 1) | -( -) | -( -) | 10( T) | 13(10) |
| KOELERIA CRISTATA | 25( 3) | -( -) | 2( T) | -( -) | 6( T) | -( -) | 8( 1) | -( -) | 5( T) | -( -) | -( -) |
| LEUCOPOA KINGII | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 1) | 1( T) | -( -) | -( -) | -( -) | -( -) |
| MELICA SPECTABILIS | -( -) | 15( T) | 10( 1) | -( -) | -( -) | 16( 2) | 9( 2) | 7( 1) | -( -) | -( -) | -( -) |
| PHLEUM ALPINUM | -( -) | -( -) | -( -) | -( -) | 3( T) | 6( 1) | 4( T) | -( -) | -( -) | -( -) | -( -) |
| POA FENDLERIANA | -( -) | -( -) | -( -) | -( -) | 21( 3) | 1( T) | 13( 1) | -( -) | 10( 3) | -( -) | 50( 3) |
| POA NERVOSA | 25( T) | 15( T) | 17( 2) | -( -) | 9( 1) | 30( 3) | 9( 2) | -( -) | -( -) | 10( T) | 13( 3) |
| POA PRATENSIS | -( -) | 31( 3) | 29(21) | 36(10) | 32(14) | 26( 9) | 10(11) | 30( 5) | 40(13) | 40( 6) | 25(13) |
| SITANION HYSTRIX | -( -) | -( -) | -( -) | 7( 1) | 29( 3) | 1( T) | 16( 2) | -( -) | 40( 1) | -( -) | 50( 1) |
| STIPA COMATA | -( -) | -( -) | -( -) | -( -) | 6( 9) | -( -) | -( -) | -( -) | 10( 4) | -( -) | 13( T) |
| STIPA LETTERMANII | -( -) | 8( T) | 6( 1) | 7( 1) | 26( 1) | 4( 2) | 17( 2) | -( -) | -( -) | -( -) | 13( 3) |
| STIPA OCCIDENTALIS | -( -) | 15( 5) | 19( 5) | 50( 6) | 53( 4) | 29( 6) | 42( 3) | 37( 5) | 80( 7) | 10(10) | 63( 6) |
| TRISETUM SPICATUM | -( -) | -( -) | 6( T) | -( -) | 12( 5) | 15( T) | 21( T) | 4( T) | 5( T) | -( -) | 13( T) |

| | POTR-ABLA/VACA C.T. | POTR-ABLA/AMAL C.T. | POTR-ABLA/SYOR/SESE C.T. | POTR-ABLA/SYOR/CAGE C.T. | POTR-ABLA/JUCO C.T. | POTR-ABLA/SESE C.T. |
|---|---|---|---|---|---|---|
| Number of Stands: | 4 | 13 | 48 | 14 | 34 | 94 |
| FORBS | | | | | | |
| ACHILLEA MILLEFOLIUM | 25( T) | 54( 1) | 52( 2) | 86( 1) | 68( 1) | 66( 3) |
| ACTAEA RUBRA | -( -) | -( -) | 2( T) | 7( T) | -( -) | 9(11) |
| AGASTACHE URTICIFOLIA | -( -) | 23( 5) | 54( 4) | -( -) | -( -) | 29( 2) |
| AGOSERIS GLAUCA | -( -) | -( -) | 4( T) | 14( T) | 6( T) | 5( T) |
| ALLIUM BREVISTYLUM | -( -) | 8( T) | 2( T) | -( -) | -( -) | -( -) |
| ALLIUM CERNUUM | -( -) | -( -) | -( -) | -( -) | 6( T) | -( -) |
| ANTENNARIA MICROPHYLLA | -( -) | -( -) | 4( T) | 7( T) | 18( 3) | 1( T) |
| ANTENNARIA PARVIFOLIA | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| APOCYNUM ANDROSAEMIFOLIUM | -( -) | 8( 3) | -( -) | -( -) | 3( T) | -( -) |
| AQUILEGIA COERULEA | -( -) | 23( 1) | 25( 1) | 14( T) | 15( 1) | 37( T) |
| ARENARIA CONGESTA | -( -) | -( -) | -( -) | -( -) | 6( 1) | -( -) |
| ARNICA CORDIFOLIA | -( -) | 8( 3) | 10( 2) | -( -) | 9( 4) | 6( 2) |
| ARNICA LATIFOLIA | 100(18) | -( -) | 2(20) | -( -) | 6(15) | 3( 7) |
| ARTEMISIA LUDOVICIANA | -( -) | -( -) | -( -) | -( -) | -( -) | 3( 1) |
| ASTER CHILENSIS | -( -) | 8( T) | 4( T) | 7( 2) | 3( T) | 1( T) |
| ASTER ENGELMANNII | 75( 1) | 62( 6) | 44( 4) | -( -) | -( -) | 48( 1) |
| ASTER FOLIACEUS | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 1) |
| ASTER OCCIDENTALIS | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| ASTRAGALUS MISER | -( -) | -( -) | 4( 1) | 14(10) | 41( 6) | 3(10) |
| CAMPANULA ROTUNDIFOLIA | -( -) | -( -) | -( -) | -( -) | 6( T) | -( -) |
| CASTILLEJA MINIATA | 75( T) | 15( T) | 13( 1) | 7( T) | 26( T) | 12( 1) |
| CHENOPODIUM FREMONTII | -( -) | 8( T) | 6( T) | -( -) | -( -) | 13( 1) |
| CHLOROCRAMBE HASTATA | -( -) | -( -) | 2( T) | -( -) | -( -) | 1( T) |
| CIRCAEA ALPINA | -( -) | -( -) | 2( 2) | -( -) | -( -) | 1( 5) |
| CIRSIUM ARVENSE | -( -) | -( -) | -( -) | 14( T) | 15( 2) | 5( T) |
| CIRSIUM VULGARE | -( -) | -( -) | -( -) | 7( T) | -( -) | -( -) |
| CLEMATIS COLUMBIANA | -( -) | 8( 8) | 2( 7) | -( -) | -( -) | 3( 1) |
| COLLINSIA PARVIFLORA | -( -) | 8( T) | 6( 1) | 7( T) | 3( 3) | 19( 6) |
| COLLOMIA LINEARIS | -( -) | -( -) | 6( T) | -( -) | -( -) | 23( 2) |
| CORALLORHIZA MACULATA | -( -) | -( -) | 4( T) | -( -) | 12( T) | 5( T) |
| DELPHINIUM NUTTALLIANUM | -( -) | 8( T) | 8( T) | 14( T) | 3( T) | 10( T) |
| DELPHINIUM OCCIDENTALE | -( -) | -( -) | 21( 6) | -( -) | -( -) | 23( 4) |
| DESCURAINIA CALIFORNICA | -( -) | -( -) | -( -) | -( -) | -( -) | 4( 2) |
| DESCURAINIA RICHARDSONII | -( -) | 15( T) | 27( 1) | 14( 1) | 6( T) | 35( 1) |
| EPILOBIUM ANGUSTIFOLIUM | 25( T) | 23( T) | 4( T) | -( -) | 9( T) | 7( T) |
| ERIGERON FLAGELLARIS | -( -) | -( -) | -( -) | 7( T) | 9( T) | -( -) |
| ERIGERON PEREGRINUS | -( -) | -( -) | -( -) | -( -) | 6( 1) | 1( 2) |
| ERIGERON SPECIOSUS | 25( T) | 8( 5) | 27( 1) | 29( 2) | 12( 1) | 18( 2) |
| ERIGERON URSINUS | -( -) | -( -) | -( -) | -( -) | 6( T) | 1( 5) |
| ERYTHRONIUM GRANDIFLORUM | 25( 5) | -( -) | 4( T) | 7( T) | -( -) | 4( 2) |
| FRAGARIA VESCA | 25( T) | 38( 3) | 27( 2) | 29( 1) | 44( 3) | 29( 1) |
| FRASERA SPECIOSA | -( -) | 46( 1) | 19( T) | 21( 2) | 18( 1) | 11( 1) |
| GALIUM APARINE | -( -) | -( -) | 4(19) | -( -) | -( -) | -( -) |
| GALIUM BIFOLIUM | -( -) | 15( T) | 10( 1) | 14( 2) | 3( 1) | 20( 8) |
| GALIUM BOREALE | 25( T) | 38( 1) | 10( T) | 7( 2) | 9( 1) | 11( T) |
| GERANIUM RICHARDSONII | 50( 3) | 8( 2) | 10(18) | 7(10) | 12( 2) | 14( 7) |
| GERANIUM VISCOSISSIMUM | -( -) | 54( 2) | 38( 3) | 29( 3) | 29( 1) | 27( 7) |
| HABENARIA UNALASCENSIS | 25( T) | -( -) | 2( T) | -( -) | 6( T) | 3( T) |
| HACKELIA FLORIBUNDA | -( -) | 31( 2) | 44( 3) | 7( T) | 6( T) | 41( 1) |
| HAPLOPAPPUS PARRYI | -( -) | -( -) | 2( T) | -( -) | -( -) | 3( T) |
| HELENIUM HOOPESII | -( -) | -( -) | 4( 1) | 43( T) | 6( T) | 6( 1) |
| HELIANTHELLA UNIFLORA | -( -) | -( -) | 4( 3) | -( -) | -( -) | 2( T) |
| HERACLEUM LANATUM | -( -) | 8( T) | 8( 3) | -( -) | -( -) | 4( 7) |
| HIERACIUM ALBIFLORUM | -( -) | 23( 1) | 2( T) | 7( T) | -( -) | 7( 1) |
| HYDROPHYLLUM CAPITATUM | 25( T) | 15( T) | 17( T) | 7( T) | -( -) | 16( 1) |
| HYDROPHYLLUM FENDLERI | -( -) | -( -) | -( -) | -( -) | -( -) | 2( 5) |
| IRIS MISSOURIENSIS | -( -) | -( -) | -( -) | -( -) | 3( 2) | -( -) |
| LATHYRUS ARIZONICUS | -( -) | -( -) | -( -) | -( -) | 3( T) | -( -) |
| LATHYRUS LANSZWERTII | 25(30) | 23(13) | 31(14) | 43(21) | 12(20) | 40(18) |
| LATHYRUS LEUCANTHUS | -( -) | 23(24) | 15(23) | 36(18) | 3(65) | 23(24) |
| LATHYRUS PAUCIFLORUS | -( -) | 31( 1) | 8( 4) | 7( T) | -( -) | 10( 1) |
| LIGUSTICUM FILICINUM | -( -) | -( -) | -( -) | -( -) | 3( T) | 4( T) |
| LIGUSTICUM PORTERI | -( -) | 15(13) | 13( 2) | 43( 2) | 18( 2) | 7( 4) |
| LUPINUS ARGENTEUS | -( -) | 23( 4) | 21( 1) | 29(13) | 26( 4) | 18( 9) |
| LUPINUS CAUDATUS | -( -) | 15( 4) | 4( 1) | -( -) | -( -) | 1( 1) |

| | POTR-ABLA/CAGE C.T. | POTR-ABCO/SYOR C.T. | POTR-ABCO/JUCO C.T. | POTR-PSME/AMAL C.T. | POTR-PSME/JUCO C.T. |
|---|---|---|---|---|---|
| Number of Stands: | 77 | 27 | 20 | 10 | 8 |
| FORBS | | | | | |
| ACHILLEA MILLEFOLIUM | 74( 2) | 48( 1) | 55( 2) | 50( 1) | 38( 1) |
| ACTAEA RUBRA | -( -) | 7( T) | -( -) | 10( T) | -( -) |
| AGASTACHE URTICIFOLIA | -( -) | 30( 3) | -( -) | 30( 7) | -( -) |
| AGOSERIS GLAUCA | 10( T) | 4( T) | 10( T) | -( -) | -( -) |
| ALLIUM BREVISTYLUM | 1( T) | -( -) | -( -) | -( -) | -( -) |
| ALLIUM CERNUUM | -( -) | -( -) | -( -) | -( -) | -( -) |
| ANTENNARIA MICROPHYLLA | 13( T) | -( -) | 10( 8) | -( -) | 13( T) |
| ANTENNARIA PARVIFOLIA | 1( 2) | -( -) | -( -) | -( -) | 13( 1) |
| APOCYNUM ANDROSAEMIFOLIUM | -( -) | -( -) | -( -) | -( -) | -( -) |
| AQUILEGIA COERULEA | 5( T) | 22( 1) | -( -) | 10( T) | 13( T) |
| ARENARIA CONGESTA | 1( T) | -( -) | -( -) | -( -) | -( -) |
| ARNICA CORDIFOLIA | 14( 2) | 4( 1) | 10( 8) | 30( 4) | 13( 3) |
| ARNICA LATIFOLIA | -( -) | -( -) | -( -) | -( -) | 25( 8) |
| ARTEMISIA LUDOVICIANA | 1( T) | -( -) | -( -) | -( -) | 13( T) |
| ASTER CHILENSIS | -( -) | 7( T) | -( -) | 10( T) | -( -) |
| ASTER ENGELMANNII | 3( T) | 41( 2) | -( -) | 40( T) | -( -) |
| ASTER FOLIACEUS | 3( T) | 7( 1) | -( -) | -( -) | -( -) |
| ASTER OCCIDENTALIS | -( -) | -( -) | -( -) | -( -) | -( -) |
| ASTRAGALUS MISER | 40( 8) | -( -) | 35( 3) | -( -) | 63( 8) |
| CAMPANULA ROTUNDIFOLIA | 1( 2) | -( -) | 5( T) | -( -) | -( -) |
| CASTILLEJA MINIATA | 16( 1) | -( -) | 15( T) | -( -) | -( -) |
| CHENOPODIUM FREMONTII | 3( 1) | 7( T) | -( -) | 10( T) | -( -) |
| CHLOROCRAMBE HASTATA | -( -) | -( -) | -( -) | -( -) | -( -) |
| CIRCAEA ALPINA | -( -) | -( -) | -( -) | -( -) | -( -) |
| CIRSIUM ARVENSE | 5( 4) | 7( T) | 15( T) | -( -) | -( -) |
| CIRSIUM VULGARE | 1( T) | -( -) | -( -) | -( -) | -( -) |
| CLEMATIS COLUMBIANA | 1( T) | -( -) | -( -) | 30( 1) | -( -) |
| COLLINSIA PARVIFLORA | 5( 3) | 4( T) | -( -) | 20( 2) | -( -) |
| COLLOMIA LINEARIS | 3( T) | 19( 1) | 5( T) | 10( 2) | -( -) |
| CORALLORHIZA MACULATA | 6( T) | -( -) | -( -) | 20( T) | -( -) |
| DELPHINIUM NUTTALLIANUM | 5( T) | -( -) | -( -) | 20( T) | -( -) |
| DELPHINIUM OCCIDENTALE | 1( T) | 15( 4) | -( -) | 10( T) | -( -) |
| DESCURAINIA CALIFORNICA | 1( T) | -( -) | -( -) | -( -) | -( -) |
| DESCURAINIA RICHARDSONII | 8( 1) | 22( T) | 5( T) | 10( T) | 13( T) |
| EPILOBIUM ANGUSTIFOLIUM | 14( T) | -( -) | -( -) | -( -) | -( -) |
| ERIGERON FLAGELLARIS | 6( T) | -( -) | 5( T) | -( -) | -( -) |
| ERIGERON PEREGRINUS | 3( 3) | -( -) | -( -) | -( -) | 13(10) |
| ERIGERON SPECIOSUS | 4( T) | 11( T) | 5( T) | 20( T) | 13( 3) |
| ERIGERON URSINUS | 1( T) | -( -) | 5( T) | -( -) | -( -) |
| ERYTHRONIUM GRANDIFLORUM | -( -) | -( -) | -( -) | 10( T) | -( -) |
| FRAGARIA VESCA | 44( 1) | 15( 3) | 25( 3) | 40( 1) | 50( 1) |
| FRASERA SPECIOSA | 6( 1) | 41( 1) | 5( T) | -( -) | 25( 2) |
| GALIUM APARINE | -( -) | -( -) | -( -) | 10( T) | -( -) |
| GALIUM BIFOLIUM | 5( T) | 11( 5) | -( -) | 20( 1) | -( -) |
| GALIUM BOREALE | 1( T) | 30( 1) | 5( 5) | 30( 1) | 25( 1) |
| GERANIUM RICHARDSONII | 3( 1) | 19( 1) | 5( 3) | -( -) | 13( T) |
| GERANIUM VISCOSISSIMUM | 8( 5) | 26( 3) | 5( T) | 50( 5) | 13( T) |
| HABENARIA UNALASCENSIS | 3( T) | -( -) | -( -) | 10( T) | -( -) |
| HACKELIA FLORIBUNDA | -( -) | 19( 2) | -( -) | 30( 1) | -( -) |
| HAPLOPAPPUS PARRYI | 10( 3) | -( -) | 5( 5) | -( -) | 13( 7) |
| HELENIUM HOOPESII | 6( 4) | 4( T) | 15( T) | -( -) | -( -) |
| HELIANTHELLA UNIFLORA | 5( T) | -( -) | -( -) | -( -) | 13( T) |
| HERACLEUM LANATUM | -( -) | 4(20) | -( -) | -( -) | -( -) |
| HIERACIUM ALBIFLORUM | 3( T) | -( -) | -( -) | -( -) | -( -) |
| HYDROPHYLLUM CAPITATUM | 4( T) | -( -) | -( -) | 30( 1) | -( -) |
| HYDROPHYLLUM FENDLERI | -( -) | -( -) | -( -) | -( -) | -( -) |
| IRIS MISSOURIENSIS | -( -) | -( -) | -( -) | -( -) | -( -) |
| LATHYRUS ARIZONICUS | 1(65) | -( -) | -( -) | -( -) | -( -) |
| LATHYRUS LANSZWERTII | 10(24) | 37(20) | 5(25) | 20(12) | -( -) |
| LATHYRUS LEUCANTHUS | 6(10) | 4(10) | 25(15) | 40(42) | 13( 5) |
| LATHYRUS PAUCIFLORUS | -( -) | 26( 2) | -( -) | -( -) | -( -) |
| LIGUSTICUM FILICINUM | 13( T) | 4( T) | -( -) | -( -) | -( -) |
| LIGUSTICUM PORTERI | 17( 1) | 15( T) | 30( 1) | 10(13) | 13( T) |
| LUPINUS ARGENTEUS | 29(10) | 15( 1) | 5( 5) | 10( T) | 50( 3) |
| LUPINUS CAUDATUS | -( -) | -( -) | -( -) | 10( T) | -( -) |

| | POTR-ABLA/VACA C.T. | POTR-ABLA/AMAL C.T. | POTR-ABLA/SYOR/SESE C.T. | POTR-ABLA/SYOR/CAGE C.T. | POTR-ABLA/JUCO C.T. | POTR-ABLA/SESE C.T. | POTR-ABLA/CAGE C.T. | POTR-ABCO/SYOR C.T. | POTR-ABCO/JUCO C.T. | POTR-PSME/AMAL C.T. | POTR-PSME/JUCO C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Stands: | 4 | 13 | 48 | 14 | 34 | 94 | 77 | 27 | 20 | 10 | 8 |
| FORBS (CONT'D) | | | | | | | | | | | |
| MERTENSIA ARIZONICA | -( -) | 8( 5) | 40( 4) | -( -) | 6( 2) | 31( 7) | 6( T) | 22( 6) | 5( T) | -( -) | -( -) |
| MERTENSIA CILIATA | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 2) | -( -) | -( -) | -( -) | -( -) | -( -) |
| MERTENSIA FRANCISCANA | -( -) | 8( 3) | 8(13) | 7( T) | -( -) | 2( 5) | -( -) | -( -) | -( -) | -( -) | -( -) |
| MERTENSIA LONGIFLORA | -( -) | -( -) | -( -) | -( -) | -( -) | 2(21) | -( -) | -( -) | -( -) | 10( T) | -( -) |
| NEMOPHILA BREVIFLORA | -( -) | 8(20) | 21(16) | -( -) | -( -) | 17(16) | -( -) | 11(13) | -( -) | 40( 2) | -( -) |
| OSMORHIZA CHILENSIS | 75( T) | 46( 1) | 48( 2) | 43( 1) | 21( 1) | 63( 2) | 18( 2) | 81( 3) | 25( T) | 70( 5) | -( -) |
| OSMORHIZA OCCIDENTALIS | -( -) | 15( T) | 17( 2) | 14( T) | -( -) | 23( 1) | -( -) | 19( 1) | 5( T) | 20( 8) | -( -) |
| PEDICULARIS RACEMOSA | -( -) | 8( 5) | -( -) | -( -) | -( -) | 2( 1) | 4(10) | -( -) | -( -) | -( -) | -( -) |
| PENSTEMON PROCERUS | -( -) | -( -) | 2( T) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| PENSTEMON RYDBERGII | -( -) | -( -) | -( -) | -( -) | -( -) | 4( 1) | 1( T) | -( -) | -( -) | 10( 5) | -( -) |
| PHACELIA HETEROPHYLLA | 25( T) | 8( T) | 17( 1) | -( -) | -( -) | 11( 1) | 1( T) | 7( T) | 5( T) | 20( T) | -( -) |
| POLEMONIUM FOLIOSISSIMUM | -( -) | 8( T) | 23( 2) | 7( T) | -( -) | 24( 1) | -( -) | 15( T) | -( -) | -( -) | -( -) |
| POLYGONUM DOUGLASII | -( -) | 8( T) | 10( 1) | 14( T) | 3( T) | 23( 4) | 9( T) | 11( 3) | -( -) | 10(10) | -( -) |
| POTENTILLA DIVERSIFOLIA | -( -) | -( -) | -( -) | -( -) | 15( 1) | -( -) | 8( T) | -( -) | 10( T) | -( -) | 13( T) |
| POTENTILLA GLANDULOSA | -( -) | 8( T) | 13( 1) | 14( T) | 9( T) | 21( 1) | 6( T) | -( -) | -( -) | 10( T) | -( -) |
| POTENTILLA GRACILIS | -( -) | -( -) | 4( 3) | 14( T) | 15( T) | 11( T) | 17( 1) | -( -) | -( -) | -( -) | 13( T) |
| PTERIDIUM AQUILINUM | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| RANUNCULUS INAMOENUS | -( -) | -( -) | 2( T) | -( -) | 9( T) | 9( T) | 8( T) | -( -) | -( -) | -( -) | -( -) |
| RUDBECKIA OCCIDENTALIS | -( -) | 31( 1) | 52(10) | 7( T) | -( -) | 55( 8) | -( -) | 41( 4) | -( -) | 50( T) | -( -) |
| SCROPHULARIA LANCEOLATA | -( -) | -( -) | 15( 2) | -( -) | -( -) | 7( 1) | -( -) | 11( T) | -( -) | -( -) | -( -) |
| SENECIO CYMBALARIOIDES | -( -) | -( -) | 17( 1) | -( -) | 3( T) | 13( 1) | 1( T) | 11( T) | -( -) | 20( T) | -( -) |
| SENECIO INTEGERRIMUS | -( -) | -( -) | 2( T) | -( -) | 3( T) | 3( T) | 4( 1) | -( -) | -( -) | -( -) | -( -) |
| SENECIO SERRA | -( -) | 46( 4) | 46( 4) | -( -) | 3( 2) | 27( 3) | -( -) | 19( 4) | -( -) | 20( T) | -( -) |
| SENECIO VULGARIS | -( -) | -( -) | -( -) | -( -) | 9( T) | -( -) | 6( 1) | -( -) | 5( T) | -( -) | 13( 3) |
| SIDALCEA OREGANA | -( -) | -( -) | 2( 3) | 7( T) | -( -) | -( -) | -( -) | 4( T) | -( -) | -( -) | -( -) |
| SILENE MENZIESII | -( -) | 23( T) | 10( T) | -( -) | 3( T) | 17( 1) | 4( 1) | -( -) | -( -) | 70( T) | -( -) |
| SMILACINA RACEMOSA | -( -) | 15( T) | 4( T) | -( -) | -( -) | 10( T) | -( -) | 4( T) | -( -) | 60( 1) | -( -) |
| SMILACINA STELLATA | -( -) | 15( T) | 23( 1) | 29( 1) | 3( T) | 13( 1) | 8( T) | 11( 1) | -( -) | 30( 5) | 25( T) |
| STELLARIA JAMESIANA | -( -) | 46( 2) | 38( 2) | 21( 2) | 3( 1) | 56( 2) | 14( 1) | 63( 1) | 5( T) | 40( T) | -( -) |
| TARAXACUM OFFICINALE | -( -) | 23( T) | 38( 1) | 64( 4) | 65( 5) | 50( 2) | 61( 1) | 48( 2) | 65( 6) | 40( T) | 50( 5) |
| THALICTRUM FENDLERI | -( -) | 85( 9) | 75(10) | 79( 7) | 41( 4) | 66( 6) | 35( 4) | 30( 3) | 35( 3) | 60( 5) | 38( 3) |
| THERMOPSIS MONTANA | -( -) | -( -) | 2( 2) | 14( 8) | -( -) | -( -) | 1(13) | -( -) | -( -) | -( -) | -( -) |
| TRAGOPOGON DUBIUS | -( -) | -( -) | 2( T) | -( -) | 3( T) | 3( T) | 3( T) | -( -) | 5( T) | 10( T) | -( -) |
| TRIFOLIUM LONGIPES | -( -) | -( -) | 2( 5) | -( -) | 15( 3) | 4(13) | 21(15) | 4( T) | 5( 5) | -( -) | -( -) |
| URTICA DIOICA | -( -) | -( -) | -( -) | -( -) | -( -) | 1( 3) | -( -) | -( -) | -( -) | -( -) | -( -) |
| VALERIANA OCCIDENTALIS | -( -) | 31( 2) | 40( 7) | 14( T) | -( -) | 34( 4) | -( -) | 33( 3) | -( -) | 10( 5) | -( -) |
| VERATRUM CALIFORNICUM | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) | -( -) |
| VICIA AMERICANA | -( -) | 15( 5) | 42( 6) | 29( 6) | 15( 8) | 24( 6) | 10(10) | 37( 6) | 20(14) | 20( 1) | -( -) |
| VIGUIERA MULTIFLORA | -( -) | -( -) | 8( 1) | -( -) | 3( T) | 3( 2) | -( -) | 7( T) | -( -) | -( -) | -( -) |
| VIOLA ADUNCA | -( -) | 46( 1) | 15( T) | -( -) | 12( T) | 17( 1) | 5( 2) | 26( 2) | -( -) | 30( 1) | -( -) |
| VIOLA CANADENSIS | -( -) | 8( T) | 6( 3) | 14( T) | 6( 5) | 6( 2) | 6( 1) | -( -) | -( -) | -( -) | -( -) |
| VIOLA NUTTALLII | -( -) | -( -) | 8( T) | 7( T) | -( -) | 27( 1) | 4( 1) | 7( 1) | -( -) | 20( T) | -( -) |

## APPENDIX A. (Con.)

| | POTR-PIPO/QUGA C.T. | POTR-PIPO/JUCO C.T. | POTR-PICO/VASC C.T. | POTR-PICO/JUCO C.T. |
|---|---|---|---|---|
| Number of Stands: | 6 | 14 | 6 | 29 |
| TREES | | | | |
| ABIES CONCOLOR | -( -) | 14( 1) | -( -) | -( -) |
| ABIES LASIOCARPA | -( -) | -( -) | 67( 2) | 28( 2) |
| PICEA ENGELMANNII | -( -) | -( -) | 17( T) | 3( 2) |
| PICEA PUNGENS | -( -) | 21( 1) | 17( 3) | 21( 1) |
| PINUS CONTORTA | -( -) | 7(17) | 100(32) | 100(23) |
| PINUS FLEXILIS | -( -) | 7( T) | -( -) | -( -) |
| PINUS PONDEROSA | 100(14) | 100(29) | -( -) | -( -) |
| POPULUS TREMULOIDES | 100(63) | 100(56) | 100(41) | 100(62) |
| PSEUDOTSUGA MENZIESII | -( -) | 29( 2) | -( -) | 7( 3) |
| SHRUBS | | | | |
| ACER GLABRUM | -( -) | -( -) | -( -) | -( -) |
| ACER GRANDIDENTATUM | -( -) | -( -) | -( -) | -( -) |
| AMELANCHIER ALNIFOLIA | 50(13) | 29( T) | 50( 1) | 21( 1) |
| ARCTOSTAPHYLOS UVA-URSI | 17( 5) | 21(11) | 17( 1) | 28( 7) |
| ARTEMISIA TRIDENTATA | -( -) | 21( 3) | -( -) | 7( 8) |
| BERBERIS REPENS | 50( 1) | 64( 2) | 83( 1) | 62( 5) |
| CEANOTHUS VELUTINUS | -( -) | -( -) | 17(10) | -( -) |
| CHRYSOTHAMNUS VISCIDIFLORUS | -( -) | -( -) | -( -) | -( -) |
| JUNIPERUS COMMUNIS | -( -) | 93( 5) | 67( 1) | 100(10) |
| PACHISTIMA MYRSINITES | -( -) | 7( T) | 83( 1) | 21( T) |
| PHYSOCARPUS MALVACEUS | -( -) | -( -) | -( -) | -( -) |
| PRUNUS VIRGINIANA | 33( 3) | -( -) | -( -) | -( -) |
| QUERCUS GAMBELII | 83(22) | -( -) | -( -) | -( -) |
| RIBES LACUSTRE | -( -) | -( -) | 17( 2) | -( -) |
| RIBES MONTIGENUM | -( -) | -( -) | -( -) | -( -) |
| RIBES SP. | -( -) | 14( 3) | -( -) | -( -) |
| ROSA WOODSII | 50( 3) | 36( T) | 50( 1) | 48( 2) |
| RUBUS PARVIFLORUS | 17( T) | -( -) | 33( 1) | -( -) |
| SALIX SCOULERIANA | 17( T) | -( -) | 33( 1) | -( -) |
| SAMBUCUS RACEMOSA | -( -) | -( -) | -( -) | -( -) |
| SHEPHERDIA CANADENSIS | -( -) | -( -) | -( -) | 10( T) |
| SORBUS SCOPULINA | -( -) | -( -) | -( -) | -( -) |
| SYMPHORICARPOS OREOPHILUS | 83(37) | 50( 6) | 17( T) | 28( 8) |
| VACCINIUM CAESPITOSUM | -( -) | -( -) | 33( 2) | -( -) |
| VACCINIUM SCOPARIUM | -( -) | -( -) | 83(13) | -( -) |
| GRAMINOIDS | | | | |
| AGROPYRON TRACHYCAULUM | 17( T) | 29( 2) | -( -) | 62( 3) |
| ARRHENATHERUM ELATIUS | -( -) | -( -) | -( -) | -( -) |
| BROMUS ANOMALUS | -( -) | 21( 5) | -( -) | -( -) |
| BROMUS CARINATUS | 33( 2) | 7( T) | 17( T) | 7( T) |
| BROMUS CILIATUS | -( -) | 7( 1) | 17( T) | 45( 2) |
| CALAMAGROSTIS RUBESCENS | -( -) | -( -) | 17(70) | -( -) |
| CAREX GEYERI | 33(59) | -( -) | 83(11) | 76(13) |
| CAREX HOODII | -( -) | -( -) | -( -) | -( -) |
| CAREX OBTUSATA | -( -) | -( -) | -( -) | -( -) |
| CAREX ROSSII | 17( 1) | 50( 1) | -( -) | 7( 1) |
| DACTYLIS GLOMERATA | 17(10) | -( -) | -( -) | -( -) |
| ELYMUS CINEREUS | -( -) | -( -) | -( -) | -( -) |
| ELYMUS GLAUCUS | 17( 2) | -( -) | 50(14) | -( -) |
| FESTUCA IDAHOENSIS | -( -) | -( -) | -( -) | 14( 6) |
| FESTUCA THURBERI | 17( T) | -( -) | -( -) | -( -) |
| KOELERIA CRISTATA | 17( 3) | 7( T) | 17( T) | -( -) |
| LEUCOPOA KINGII | -( -) | -( -) | -( -) | -( -) |
| MELICA SPECTABILIS | -( -) | -( -) | -( -) | 3( T) |
| PHLEUM ALPINUM | -( -) | -( -) | 33( 1) | -( -) |
| POA FENDLERIANA | 17( 3) | 57( 3) | -( -) | 7( 6) |
| POA NERVOSA | -( -) | 7( 2) | 17( T) | 10( 1) |
| POA PRATENSIS | 83(16) | 21( 2) | -( -) | 31( 5) |
| SITANION HYSTRIX | 17( 1) | 57( 5) | -( -) | -( -) |
| STIPA COMATA | -( -) | 29(10) | -( -) | -( -) |
| STIPA LETTERMANII | -( -) | 7( 1) | -( -) | 3( T) |
| STIPA OCCIDENTALIS | 17( T) | 21( T) | -( -) | 76( 5) |
| TRISETUM SPICATUM | 17( T) | -( -) | 50( 2) | 38( 1) |

## APPENDIX A. (Con.)

| | POTR-PIPO/QUGA C.T. | POTR-PIPO/JUCO C.T. | POTR-PICO/VASC C.T. | POTR-PICO/JUCO C.T. |
|---|---|---|---|---|
| Number of Stands: | 6 | 14 | 6 | 29 |
| FORBS | | | | |
| ACHILLEA MILLEFOLIUM | 83( T) | 36( 2) | 50( 1) | 90( 2) |
| ACTAEA RUBRA | -( -) | -( -) | 17( 1) | -( -) |
| AGASTACHE URTICIFOLIA | -( -) | -( -) | -( -) | 3( 3) |
| AGOSERIS GLAUCA | -( -) | 14( T) | -( -) | 21( T) |
| ALLIUM BREVISTYLUM | -( -) | 7( T) | -( -) | 7( 7) |
| ALLIUM CERNUUM | -( -) | 7( T) | -( -) | 3( T) |
| ANTENNARIA MICROPHYLLA | -( -) | 43( T) | 33( 5) | 55( 1) |
| ANTENNARIA PARVIFOLIA | -( -) | -( -) | -( -) | -( -) |
| APOCYNUM ANDROSAEMIFOLIUM | -( -) | -( -) | -( -) | 3( T) |
| AQUILEGIA COERULEA | -( -) | -( -) | 17( 1) | 14( 1) |
| ARENARIA CONGESTA | -( -) | 7( T) | -( -) | 7( 1) |
| ARNICA CORDIFOLIA | -( -) | -( -) | 33( 1) | 7( 1) |
| ARNICA LATIFOLIA | -( -) | -( -) | 33(15) | 38( 8) |
| ARTEMISIA LUDOVICIANA | -( -) | -( -) | -( -) | -( -) |
| ASTER CHILENSIS | -( -) | -( -) | -( -) | -( -) |
| ASTER ENGELMANNII | -( -) | -( -) | 17( T) | 3( T) |
| ASTER FOLIACEUS | -( -) | -( -) | -( -) | -( -) |
| ASTER OCCIDENTALIS | -( -) | -( -) | -( -) | 10(17) |
| ASTRAGALUS MISER | -( -) | 29( 4) | -( -) | 66(15) |
| CAMPANULA ROTUNDIFOLIA | -( -) | -( -) | 33( T) | 10( 1) |
| CASTILLEJA MINIATA | -( -) | -( -) | 33( 1) | 31( 1) |
| CHENOPODIUM FREMONTII | -( -) | -( -) | -( -) | 3( T) |
| CHLOROCRAMBE HASTATA | -( -) | -( -) | -( -) | -( -) |
| CIRCAEA ALPINA | -( -) | -( -) | -( -) | -( -) |
| CIRSIUM ARVENSE | -( -) | -( -) | -( -) | -( -) |
| CIRSIUM VULGARE | -( -) | -( -) | -( -) | -( -) |
| CLEMATIS COLUMBIANA | -( -) | -( -) | 17( 1) | 3( T) |
| COLLINSIA PARVIFLORA | 17( T) | -( -) | -( -) | 7( 1) |
| COLLOMIA LINEARIS | -( -) | -( -) | -( -) | -( -) |
| CORALLORHIZA MACULATA | 17( T) | -( -) | -( -) | 3( T) |
| DELPHINIUM NUTTALLIANUM | 17( T) | -( -) | -( -) | 7( 2) |
| DELPHINIUM OCCIDENTALE | -( -) | -( -) | -( -) | -( -) |
| DESCURAINIA CALIFORNICA | -( -) | -( -) | -( -) | -( -) |
| DESCURAINIA RICHARDSONII | -( -) | 7( T) | -( -) | 3( T) |
| EPILOBIUM ANGUSTIFOLIUM | 17( T) | -( -) | -( -) | 14( T) |
| ERIGERON FLAGELLARIS | -( -) | -( -) | -( -) | 3( T) |
| ERIGERON PEREGRINUS | -( -) | -( -) | -( -) | 34( 5) |
| ERIGERON SPECIOSUS | 17( T) | 21( 1) | -( -) | 14( T) |
| ERIGERON URSINUS | 17( T) | 7( 2) | -( -) | 3( T) |
| ERYTHRONIUM GRANDIFLORUM | -( -) | -( -) | -( -) | -( -) |
| FRAGARIA VESCA | 17(10) | 43( 1) | 33( 1) | 48( 2) |
| FRASERA SPECIOSA | 17( T) | -( -) | -( -) | 24( 2) |
| GALIUM APARINE | -( -) | -( -) | -( -) | 3( T) |
| GALIUM BIFOLIUM | -( -) | -( -) | -( -) | 3( T) |
| GALIUM BOREALE | -( -) | 7( T) | 50( 1) | 45( T) |
| GERANIUM RICHARDSONII | -( -) | -( -) | 17(10) | 14( 2) |
| GERANIUM VISCOSISSIMUM | 33( T) | 29( 1) | 17(10) | 62( 2) |
| HABENARIA UNALASCENSIS | -( -) | -( -) | 17( T) | -( -) |
| HACKELIA FLORIBUNDA | -( -) | -( -) | -( -) | 7( T) |
| HAPLOPAPPUS PARRYI | -( -) | -( -) | -( -) | 10( 6) |
| HELENIUM HOOPESII | -( -) | -( -) | 17( T) | -( -) |
| HELIANTHELLA UNIFLORA | -( -) | -( -) | -( -) | 3( T) |
| HERACLEUM LANATUM | -( -) | -( -) | -( -) | -( -) |
| HIERACIUM ALBIFLORUM | -( -) | -( -) | 17( T) | 14( T) |
| HYDROPHYLLUM CAPITATUM | -( -) | -( -) | -( -) | -( -) |
| HYDROPHYLLUM FENDLERI | -( -) | -( -) | -( -) | -( -) |
| IRIS MISSOURIENSIS | -( -) | -( -) | -( -) | -( -) |
| LATHYRUS ARIZONICUS | -( -) | -( -) | -( -) | -( -) |
| LATHYRUS LANSZWERTII | 17( 5) | -( -) | 50( 5) | 21(12) |
| LATHYRUS LEUCANTHUS | 33(24) | 7( T) | -( -) | -( -) |
| LATHYRUS PAUCIFLORUS | -( -) | -( -) | -( -) | -( -) |
| LIGUSTICUM FILICINUM | -( -) | -( -) | 17( T) | 7( 2) |
| LIGUSTICUM PORTERI | 50( 3) | -( -) | -( -) | 3( 3) |
| LUPINUS ARGENTEUS | 17( 1) | 29( 4) | 17( 3) | 66( 6) |
| LUPINUS CAUDATUS | -( -) | -( -) | -( -) | -( -) |

| | POTR-PIPO/QUGA C.T. | POTR-PIPO/JUCO C.T. | POTR-PICO/VASC C.T. | POTR-PICO/JUCO C.T. |
|---|---|---|---|---|
| Number of Stands: | 6 | 14 | 6 | 29 |
| FORBS (CONT'D) | | | | |
| MERTENSIA ARIZONICA | -( -) | -( -) | -( -) | -( -) |
| MERTENSIA CILIATA | -( -) | -( -) | 17( T) | -( -) |
| MERTENSIA FRANCISCANA | -( -) | -( -) | -( -) | -( -) |
| MERTENSIA LONGIFLORA | -( -) | -( -) | -( -) | -( -) |
| NEMOPHILA BREVIFLORA | -( -) | -( -) | -( -) | -( -) |
| OSMORHIZA CHILENSIS | 17( 5) | 7( T) | 50( 3) | 38( 1) |
| OSMORHIZA OCCIDENTALIS | -( -) | -( -) | -( -) | -( -) |
| PEDICULARIS RACEMOSA | -( -) | -( -) | -( -) | -( -) |
| PENSTEMON PROCERUS | -( -) | -( -) | -( -) | -( -) |
| PENSTEMON RYDBERGII | -( -) | -( -) | -( -) | -( -) |
| PHACELIA HETEROPHYLLA | -( -) | -( -) | -( -) | -( -) |
| POLEMONIUM FOLIOSISSIMUM | -( -) | -( -) | -( -) | -( -) |
| POLYGONUM DOUGLASII | -( -) | -( -) | -( -) | 3( T) |
| POTENTILLA DIVERSIFOLIA | 17( T) | 7( T) | -( -) | 3( T) |
| POTENTILLA GLANDULOSA | -( -) | -( -) | -( -) | -( -) |
| POTENTILLA GRACILIS | 17( T) | -( -) | 17( T) | 41( 1) |
| PTERIDIUM AQUILINUM | -( -) | -( -) | -( -) | -( -) |
| RANUNCULUS INAMOENUS | -( -) | -( -) | -( -) | -( -) |
| RUDBECKIA OCCIDENTALIS | -( -) | -( -) | -( -) | -( -) |
| SCROPHULARIA LANCEOLATA | -( -) | -( -) | -( -) | -( -) |
| SENECIO CYMBALARIOIDES | 17( T) | -( -) | -( -) | 3( T) |
| SENECIO INTEGERRIMUS | -( -) | -( -) | -( -) | -( -) |
| SENECIO SERRA | -( -) | -( -) | -( -) | -( -) |
| SENECIO VULGARIS | -( -) | 29( 1) | -( -) | -( -) |
| SIDALCEA OREGANA | -( -) | -( -) | -( -) | -( -) |
| SILENE MENZIESII | -( -) | -( -) | -( -) | 7( T) |
| SMILACINA RACEMOSA | -( -) | -( -) | -( -) | -( -) |
| SMILACINA STELLATA | 33( 2) | -( -) | 33( T) | 14( 1) |
| STELLARIA JAMESIANA | 33( T) | 7( T) | 17( T) | 14( 1) |
| TARAXACUM OFFICINALE | 50( 4) | 57( 1) | 17( 1) | 59( 4) |
| THALICTRUM FENDLERI | 67( 7) | 21( T) | 33( 2) | 55(10) |
| THERMOPSIS MONTANA | 67( 9) | -( -) | -( -) | 7( 4) |
| TRAGOPOGON DUBIUS | -( -) | -( -) | -( -) | -( -) |
| TRIFOLIUM LONGIPES | -( -) | 7( 3) | 17( T) | 21( 9) |
| URTICA DIOICA | -( -) | -( -) | -( -) | -( -) |
| VALERIANA OCCIDENTALIS | -( -) | -( -) | -( -) | -( -) |
| VERATRUM CALIFORNICUM | -( -) | -( -) | 17( 4) | -( -) |
| VICIA AMERICANA | -( -) | 7( T) | -( -) | 3( T) |
| VIGUIERA MULTIFLORA | -( -) | -( -) | -( -) | -( -) |
| VIOLA ADUNCA | -( -) | -( -) | 17( T) | 14( T) |
| VIOLA CANADENSIS | -( -) | -( -) | 17( 2) | -( -) |
| VIOLA NUTTALLII | -( -) | -( -) | -( -) | 3( T) |

## APPENDIX B1: MEANS, STANDARD ERROR (SE), AND RANGES OF BASAL AREA, STAND AGE, STAND HEIGHT, AND SITE INDEX FOR *POPULUS TREMULOIDES* BY COMMUNITY TYPES IN UTAH, IN METRIC UNITS

| Community type | *P. tremuloides* basal area | Stand age | Stand height | Site index at 80 years |
|---|---|---|---|---|
| | *$m^2$/ha* | *Years* | *---------- Meters* | *----------* |
| POTR/ACGR/PTAQ (5)[1] | | | | |
| mean | 31.2 | 73 | 16.8 | 18.0 |
| SE | 2.4 | 13 | 0.8 | 1.4 |
| range | 25.8-40.0 | 58-119 | 16.2-18.9 | 13.7-21.0 |
| POTR/PRVI/SESE (42) | | | | |
| mean | 27.9 | 78 | 14.2 | 14.4 |
| SE | 1.3 | 3 | 0.5 | 0.5 |
| range | 10.4-46.4 | 51-126 | 8.8-22.6 | 9.4-20.7 |
| POTR/PRVI/CAGE (7) | | | | |
| mean | 23.4 | 82 | 14.2 | 14.1 |
| SE | 2.7 | 8 | 1.4 | 1.2 |
| range | 16.3-35.7 | 59-112 | 10.1-21.0 | 10.4-18.9 |
| POTR/SARA (8) | | | | |
| mean | 34.3 | 89 | 17.0 | 16.5 |
| SE | 4.3 | 12 | 1.1 | 1.0 |
| range | 16.1-48.5 | 52-144 | 12.8-22.0 | 11.6-19.8 |
| POTR/SYOR/SESE (42) | | | | |
| mean | 26.0 | 88 | 15.1 | 14.5 |
| SE | 1.8 | 4 | 0.6 | 0.5 |
| range | 3.3-53.4 | 48-142 | 6.7-22.6 | 7.9-21.6 |
| POTR/SYOR/CAGE (14) | | | | |
| mean | 37.4 | 87 | 16.5 | 15.3 |
| SE | 4.0 | 7 | 1.5 | 1.1 |
| range | 16.9-67.0 | 42-141 | 8.5-21.6 | 10.7-22.9 |
| POTR/SYOR/FETH (2) | | | | |
| mean | 38.7 | 84 | 18.0 | 17.5 |
| SE | 1.9 | 10 | 0.6 | 1.7 |
| range | 36.8-40.6 | 75-94 | 17.4-18.6 | 15.8-19.2 |
| POTR/JUCO/CAGE (11) | | | | |
| mean | 32.9 | 99 | 15.5 | 13.7 |
| SE | 3.9 | 4 | 1.2 | 1.0 |
| range | 10.5-51.7 | 78-122 | 8.8-23.2 | 7.0-20.7 |
| POTR/SYOR/BRCA (2) | | | | |
| mean | 22.3 | 72 | 16.0 | 16.8 |
| SE | 0.1 | 1 | 2.3 | 2.1 |
| range | 22.2-22.3 | 71-73 | 13.7-18.3 | 14.6-18.9 |
| POTR/SYOR/POPR (3) | | | | |
| mean | 26.9 | 77 | 13.9 | 14.2 |
| SE | 4.9 | 7 | 1.1 | 0.6 |
| range | 22.0-36.7 | 67-91 | 11.9-15.5 | 13.1-15.2 |
| POTR/VECA (1) | | | | |
| mean | 16.4 | 41 | 14.6 | 21.3 |
| SE | — | — | — | — |
| range | — | — | — | — |
| POTR/HELA (5) | | | | |
| mean | 42.0 | 86 | 20.7 | 19.9 |
| SE | 8.5 | 7 | 2.4 | 1.9 |
| range | 20.0-65.1 | 59-93 | 14.9-25.9 | 13.7-23.8 |
| POTR/PTAQ (5) | | | | |
| mean | 33.4 | 93 | 19.8 | 18.3 |
| SE | 5.6 | 4 | 1.8 | 1.7 |
| range | 16.6-51.4 | 82-105 | 15.2-25.9 | 14.3-23.8 |
| POTR/SESE (64) | | | | |
| mean | 34.7 | 93 | 17.5 | 16.5 |
| SE | 1.6 | 3 | 0.5 | 0.4 |
| range | 10.7-69.4 | 43-163 | 10.1-27.1 | 9.8-25.9 |

(con.)

## APPENDIX B1. (Con.)

| Community type | *P. tremuloides* basal area | Stand age | Stand height | Site index at 80 years |
|---|---|---|---|---|
| | *m²/ha* | *Years* | --------- *Meters* | --------- |
| POTR/CAGE (24) | | | | |
| mean | 38.9 | 91 | 16.7 | 15.7 |
| SE | 3.2 | 4 | 0.9 | 0.8 |
| range | 20.5-73.9 | 42-125 | 8.5-25.6 | 9.8-23.5 |
| POTR/FETH (5) | | | | |
| mean | 45.5 | 104 | 20.3 | 17.9 |
| SE | 7.6 | 11 | 1.5 | 0.6 |
| range | 30.7-74.2 | 73-136 | 15.2-24.4 | 16.2-19.2 |
| POTR/SIHY (5) | | | | |
| mean | 34.3 | 96 | 14.9 | 14.3 |
| SE | 4.7 | 11 | 1.8 | 1.7 |
| range | 21.3-45.5 | 73-137 | 11.9-22.0 | 9.1-19.2 |
| POTR/BRCA (7) | | | | |
| mean | 29.5 | 90 | 18.0 | 17.0 |
| SE | 4.5 | 8 | 1.2 | 1.2 |
| range | 9.0-43.4 | 64-119 | 13.4-24.1 | 14.6-24.1 |
| POTR/POPR (9) | | | | |
| mean | 28.6 | 98 | 17.8 | 16.1 |
| SE | 3.1 | 9 | 1.7 | 1.5 |
| range | 16.3-44.3 | 63-136 | 8.2-24.1 | 9.1-21.3 |
| POTR-ABLA/AMAL (6) | | | | |
| mean | 29.4 | 97 | 17.7 | 16.5 |
| SE | 6.8 | 9 | 1.6 | 0.8 |
| range | 9.9-58.6 | 61-127 | 14.0-23.2 | 14.3-20.1 |
| POTR-ABLA/SYOR/SESE (14) | | | | |
| mean | 33.0 | 96 | 18.1 | 16.6 |
| SE | 2.5 | 3 | 0.9 | 1.0 |
| range | 14.8-48.9 | 79-129 | 13.1-23.2 | 10.1-22.6 |
| POTR-ABLA/SYOR/CAGE (3) | | | | |
| mean | 20.7 | 100 | 13.1 | 11.5 |
| SE | 6.3 | 5 | 1.3 | 1.3 |
| range | 9.0-30.6 | 92-108 | 11.3-15.5 | 9.1-13.7 |
| POTR-ABLA/JUCO (12) | | | | |
| mean | 34.4 | 100 | 17.5 | 15.7 |
| SE | 3.2 | 5 | 1.2 | 1.1 |
| range | 21.2-58.7 | 75-135 | 12.8-24.7 | 9.8-21.6 |
| POTR-ABLA/SESE (49) | | | | |
| mean | 31.4 | 101 | 17.7 | 15.8 |
| SE | 1.7 | 3 | 0.5 | 0.4 |
| range | 15.8-78.5 | 66-151 | 9.4-25.0 | 10.1-22.6 |
| POTR-ABLA/CAGE (36) | | | | |
| mean | 36.6 | 109 | 17.2 | 14.8 |
| SE | 2.2 | 5 | 0.6 | 0.5 |
| range | 10.8-65.0 | 62-117 | 8.5-26.2 | 7.6-19.5 |
| POTR-ABCO/SYOR (8) | | | | |
| mean | 28.4 | 98 | 14.2 | 12.8 |
| SE | 2.2 | 6 | 1.1 | 1.2 |
| range | 20.9-36.9 | 68-112 | 10.7-19.2 | 8.8-19.2 |
| POTR-PSME/AMAL (4) | | | | |
| mean | 31.4 | 100 | 20.3 | 18.3 |
| SE | 10.5 | 6 | 0.8 | 1.1 |
| range | 19.6-62.9 | 90-112 | 18.3-21.6 | 15.2-20.1 |
| POTR-PIPO/QUGA (1) | | | | |
| mean | 29.1 | 118 | 14.9 | 12.2 |
| SE | — | — | — | — |
| range | — | — | — | — |

(con.)

## APPENDIX B1. (Con.)

| Community type | *P. tremuloides* basal area | Stand age | Stand height | Site index at 80 years |
|---|---|---|---|---|
| | *m²/ha* | *Years* | --------- *Meters* | --------- |
| POTR-PIPO/JUCO (1) | | | | |
| mean | 25.5 | 139 | 23.5 | 17.4 |
| SE | — | — | — | — |
| range | — | — | — | — |
| POTR-PICO/JUCO (6) | | | | |
| mean | 26.0 | 109 | 15.2 | 12.9 |
| SE | 2.1 | 9 | 0.6 | 0.7 |
| range | 19.4-32.9 | 92-152 | 13.4-16.8 | 11.3-15.5 |

[1]Number of intensively sampled stands.

## APPENDIX B2: MEANS, STANDARD ERRORS (SE), AND RANGES OF BASAL AREA, STAND SIZE, STAND HEIGHT, AND SITE INDEX FOR *POPULUS TREMULOIDES* BY COMMUNITY TYPES IN UTAH, IN ENGLISH UNITS

| Community type | *P. tremuloides* basal area | Stand age | Stand height | Site index at 80 years |
|---|---|---|---|---|
| | *Ft²/acre* | *Years* | ---------- *Feet* | ---------- |
| POTR/ACGR/PTAQ (5)[1] | | | | |
| mean | 136 | 73 | 55 | 59 |
| SE | 10 | 13 | 2 | 4 |
| range | 113-174 | 45-119 | 47-62 | 45-69 |
| POTR/PRVI/SESE (42) | | | | |
| mean | 121 | 78 | 47 | 47 |
| SE | 6 | 3 | 2 | 2 |
| range | 45-202 | 51-126 | 29-74 | 31-68 |
| POTR/PRVI/CAGE (7) | | | | |
| mean | 102 | 82 | 47 | 46 |
| SE | 12 | 8 | 4 | 4 |
| range | 71-155 | 59-112 | 33-69 | 34-62 |
| POTR/SARA (8) | | | | |
| mean | 149 | 89 | 56 | 54 |
| SE | 19 | 12 | 4 | 3 |
| range | 70-211 | 52-144 | 42-72 | 38-65 |
| POTR/SYOR/SESE (42) | | | | |
| mean | 113 | 88 | 50 | 48 |
| SE | 8 | 4 | 2 | 2 |
| range | 14-233 | 48-142 | 22-74 | 26-71 |
| POTR/SYOR/CAGE (14) | | | | |
| mean | 163 | 87 | 54 | 50 |
| SE | 17 | 7 | 5 | 4 |
| range | 74-292 | 42-141 | 28-82 | 35-75 |
| POTR/SYOR/FETH (2) | | | | |
| mean | 168 | 84 | 59 | 58 |
| SE | 8 | 10 | 2 | 6 |
| range | 160-177 | 75-94 | 57-61 | 52-63 |
| POTR/JUCO/CAGE (11) | | | | |
| mean | 143 | 99 | 51 | 45 |
| SE | 17 | 4 | 4 | 3 |
| range | 46-225 | 78-122 | 29-76 | 23-68 |
| POTR/SYOR/BRCA (2) | | | | |
| mean | 97 | 72 | 52 | 55 |
| SE | 1 | 1 | 8 | 7 |
| range | 96-97 | 71-73 | 45-60 | 48-62 |

(con.)

## APPENDIX B2. (Con.)

| Community type | *P. tremuloides* basal area | Stand age | Stand height | Site index at 80 years |
|---|---|---|---|---|
| | *Ft²/acre* | *Years* | ---------- *Feet* | ---------- |
| POTR/SYOR/POPR (3) | | | | |
| mean | 117 | 77 | 46 | 47 |
| SE | 21 | 7 | 4 | 2 |
| range | 96-160 | 67-91 | 39-51 | 43-50 |
| POTR/VECA (1) | | | | |
| mean | 71 | 41 | 48 | 70 |
| SE | — | — | — | — |
| range | — | — | — | — |
| POTR/HELA (5) | | | | |
| mean | 183 | 86 | 68 | 65 |
| SE | 37 | 7 | 8 | 6 |
| range | 87-283 | 59-93 | 49-85 | 45-78 |
| POTR/PTAQ (5) | | | | |
| mean | 145 | 93 | 65 | 60 |
| SE | 24 | 4 | 6 | 6 |
| range | 72-224 | 82-105 | 50-85 | 47-78 |
| POTR/SESE (64) | | | | |
| mean | 151 | 93 | 58 | 54 |
| SE | 7 | 3 | 2 | 1 |
| range | 46-302 | 43-163 | 33-89 | 32-85 |
| POTR/CAGE (24) | | | | |
| mean | 169 | 91 | 55 | 52 |
| SE | 14 | 4 | 3 | 2 |
| range | 89-322 | 42-125 | 28-84 | 32-77 |
| POTR/FETH (5) | | | | |
| mean | 198 | 104 | 67 | 59 |
| SE | 33 | 11 | 5 | 2 |
| range | 134-323 | 73-136 | 50-80 | 53-63 |
| POTR/SIHY (5) | | | | |
| mean | 150 | 96 | 49 | 47 |
| SE | 21 | 11 | 6 | 6 |
| range | 93-198 | 73-137 | 39-72 | 30-63 |
| POTR/BRCA (7) | | | | |
| mean | 128 | 90 | 59 | 56 |
| SE | 20 | 8 | 4 | 4 |
| range | 39-189 | 64-119 | 44-79 | 48-79 |
| POTR/POPR (9) | | | | |
| mean | 125 | 98 | 58 | 53 |
| SE | 14 | 9 | 5 | 5 |
| range | 71-193 | 63-136 | 27-79 | 30-70 |
| POTR-ABLA/AMAL (6) | | | | |
| mean | 128 | 97 | 58 | 54 |
| SE | 30 | 9 | 5 | 3 |
| range | 43-255 | 61-127 | 46-76 | 47-66 |
| POTR-ABLA/SYOR/SESE (14) | | | | |
| mean | 144 | 96 | 60 | 54 |
| SE | 11 | 3 | 3 | 3 |
| range | 64-213 | 79-129 | 43-76 | 33-74 |
| POTR-ABLA/SYOR/CAGE (3) | | | | |
| mean | 90 | 100 | 43 | 38 |
| SE | 27 | 5 | 4 | 4 |
| range | 39-133 | 92-108 | 37-51 | 30-45 |
| POTR-ABLA/JUCO (12) | | | | |
| mean | 150 | 100 | 57 | 52 |
| SE | 14 | 5 | 4 | 4 |
| range | 92-255 | 75-135 | 42-81 | 32-71 |

(con.)

## APPENDIX B2. (Con.)

| Community type | *P. tremuloides* basal area | Stand age | Stand height | Site index at 80 years |
|---|---|---|---|---|
| | *Ft²/acre* | *Years* | ---------- *Feet* | ---------- |
| POTR-ABLA/SESE (49) | | | | |
| mean | 137 | 101 | 58 | 52 |
| SE | 7 | 3 | 2 | 1 |
| range | 69-342 | 66-151 | 31-82 | 33-74 |
| POTR-ABLA/CAGE (36) | | | | |
| mean | 160 | 109 | 56 | 48 |
| SE | 10 | 5 | 2 | 2 |
| range | 47-283 | 62-177 | 28-72 | 25-64 |
| POTR-ABCO/SYOR (8) | | | | |
| mean | 124 | 98 | 47 | 42 |
| SE | 10 | 6 | 4 | 4 |
| range | 91-161 | 68-112 | 35-63 | 29-63 |
| POTR-PSME/AMAL (4) | | | | |
| mean | 137 | 100 | 66 | 60 |
| SE | 46 | 6 | 2 | 4 |
| range | 85-274 | 90-112 | 60-71 | 50-66 |
| POTR-PIPO/QUGA (1) | | | | |
| mean | 127 | 118 | 49 | 40 |
| SE | — | — | — | — |
| range | — | — | — | — |
| POTR-PIPO/JUCO (1) | | | | |
| mean | 111 | 139 | 77 | 57 |
| SE | — | — | — | — |
| range | — | — | — | — |
| POTR-PICO/JUCO (6) | | | | |
| mean | 113 | 109 | 50 | 42 |
| SE | 9 | 9 | 2 | 2 |
| range | 84-143 | 92-152 | 44-53 | 37-51 |

[1]Number of intensively sampled stands.

## APPENDIX C: MEANS, STANDARD ERRORS (SE), AND RANGES OF TREE BASAL AREA, AND PERCENT OF THIS BASAL AREA CONSISTING OF CONIFERS, BY COMMUNITY TYPE IN UTAH

| Community type | N[1] | Total basal area | | Percent conifers |
|---|---|---|---|---|
| | | $m^2/ha$ | $Ft^2/acre$ | |
| POTR/ACGR/PTAQ | 5 | | | |
| mean | | 31.2 | 136 | 0 |
| SE | | 2.4 | 11 | |
| range | | 25.8-40.0 | 113-174 | |
| POTR/PRVI/SESE | 42 | | | |
| mean | | 28.0 | 122 | T[2] |
| SE | | 1.3 | 5 | |
| range | | 10.4-46.4 | 42-202 | |
| POTR/PRVI/CAGE | 7 | | | |
| mean | | 23.8 | 104 | 2 |
| SE | | 2.8 | 12 | |
| range | | 16.2-35.7 | 71-155 | |
| POTR/SARA | 8 | | | |
| mean | | 34.5 | 150 | 1 |
| SE | | 4.3 | 19 | |
| range | | 16.1-48.5 | 70-211 | |
| POTR/SYOR/SESE | 42 | | | |
| mean | | 26.4 | 115 | 2 |
| SE | | 1.8 | 8 | |
| range | | 3.3-53.4 | 14-233 | |
| POTR/SYOR/CAGE | 14 | | | |
| mean | | 37.8 | 165 | 1 |
| SE | | 4.0 | 17 | |
| range | | 16.9-67.0 | 74-292 | |
| POTR/SYOR/FETH | 2 | | | |
| mean | | 38.9 | 169 | 1 |
| SE | | 2.0 | 9 | |
| range | | 36.8-40.9 | 160-178 | |
| POTR/JUCO/CAGE | 11 | | | |
| mean | | 33.5 | 146 | 2 |
| SE | | 4.0 | 17 | |
| range | | 10.9-53.6 | 47-234 | |
| POTR/SYOR/BRCA | 2 | | | |
| mean | | 23.7 | 103 | 6 |
| SE | | 1.4 | 6 | |
| range | | 22.3-25.1 | 97-109 | |
| POTR/SYOR/POPR | 3 | | | |
| mean | | 26.9 | 117 | 0 |
| SE | | 4.9 | 21 | |
| range | | 22.0-36.7 | 96-160 | |
| POTR/VECA | 1 | | | |
| mean | | 16.4 | 71 | 0 |
| SE | | — | — | |
| range | | — | — | |
| POTR/HELA | 5 | | | |
| mean | | 42.0 | 183 | 0 |
| SE | | 8.5 | 37 | |
| range | | 19.9-65.1 | 87-283 | |
| POTR/PTAQ | 5 | | | |
| mean | | 33.6 | 146 | 1 |
| SE | | 5.4 | 24 | |
| range | | 17.3-51.4 | 76-224 | |
| POTR/SESE | 64 | | | |
| mean | | 35.0 | 152 | 1 |
| SE | | 1.6 | 7 | |
| range | | 10.7-69.4 | 46-302 | |

(con.)

## APPENDIX C. (Con.)

| Community type | N[1] | Total basal area | | Percent conifers |
|---|---|---|---|---|
| | | *m²/ha* | *Ft²/acre* | |
| POTR/CAGE | 24 | | | |
| mean | | 39.2 | 171 | 1 |
| SE | | 3.2 | 14 | |
| range | | 20.5-73.9 | 89-322 | |
| POTR/FETH | 5 | | | |
| mean | | 45.6 | 199 | T |
| SE | | 7.7 | 33 | |
| range | | 30.8-74.6 | 134-325 | |
| POTR/SIHY | 5 | | | |
| mean | | 35.7 | 155 | 4 |
| SE | | 4.7 | 21 | |
| range | | 21.5-46.6 | 94-203 | |
| POTR/BRCA | 7 | | | |
| mean | | 29.6 | 129 | T |
| SE | | 4.5 | 20 | |
| range | | 9.0-43.4 | 39-189 | |
| POTR/POPR | 9 | | | |
| mean | | 28.9 | 126 | 1 |
| SE | | 3.1 | 13 | |
| range | | 16.3-44.3 | 71-193 | |
| POTR-ABLA/AMAL | 6 | | | |
| mean | | 34.4 | 150 | 15 |
| SE | | 7.6 | 33 | |
| range | | 12.1-66.2 | 53-288 | |
| POTR-ABLA/SYOR/SESE | 14 | | | |
| mean | | 38.0 | 165 | 13 |
| SE | | 3.3 | 14 | |
| range | | 17.0-57.3 | 74-249 | |
| POTR-ABLA/SYOR/CAGE | 3 | | | |
| mean | | 25.0 | 109 | 17 |
| SE | | 5.1 | 22 | |
| range | | 15.5-33.0 | 67-144 | |
| POTR-ABLA/JUCO | 12 | | | |
| mean | | 38.1 | 166 | 10 |
| SE | | 3.3 | 14 | |
| range | | 22.5-60.4 | 98-263 | |
| POTR-ABLA/SESE | 49 | | | |
| mean | | 40.7 | 177 | 23 |
| SE | | 1.9 | 8 | |
| range | | 20.4-80.6 | 89-351 | |
| POTR-ABLA/CAGE | 36 | | | |
| mean | | 45.6 | 199 | 20 |
| SE | | 2.1 | 9 | |
| range | | 21.3-73.4 | 93-320 | |
| POTR-ABCO/SYOR | 8 | | | |
| mean | | 40.7 | 177 | 30 |
| SE | | 3.1 | 14 | |
| range | | 24.2-49.3 | 106-215 | |
| POTR-PSME/AMAL | 4 | | | |
| mean | | 36.7 | 160 | 14 |
| SE | | 9.5 | 41 | |
| range | | 24.2-64.9 | 105-283 | |
| POTR-PIPO/QUGA | 1 | | | |
| mean | | 39.1 | 170 | 26 |
| SE | | — | — | |
| range | | — | — | |

(con.)

## APPENDIX C. (Con.)

| Community type | N[1] | Total basal area | | Percent conifers |
|---|---|---|---|---|
| | | *m²/ha* | *Ft²/acre* | |
| POTR-PIPO/JUCO | 1 | | | |
| mean | | 44.3 | 193 | 42 |
| SE | | — | — | |
| range | | — | — | |
| POTR-PICO/JUCO | 6 | | | |
| mean | | 31.0 | 135 | 16 |
| SE | | 2.6 | 11 | |
| range | | 23.8-40.8 | 104-178 | |

[1]Number of intensively sampled stands.
[2]T = less than 0.5 percent.

## APPENDIX D1: MEANS, STANDARD ERRORS (SE), AND RANGES OF ANNUAL UNDERGROWTH PRODUCTION BY VEGETATION CLASSES EXPRESSED IN DRY WEIGHT KILOGRAMS PER HECTARE

| Community type | N[1] | Shrubs | Forbs | Graminoids | Total |
|---|---|---|---|---|---|
| | | kg/ha | | | |
| POTR/ACGR/PTAQ | 5 | | | | |
| mean | | 146 | 2,012 | 162 | 2,320 |
| SE | | 112 | 559 | 105 | 577 |
| range | | 18-594 | 882-4,001 | 9-552 | 938-4,256 |
| POTR/PRVI/SESE | 41 | | | | |
| mean | | 386 | 610 | 285 | 1,281 |
| SE | | 37 | 56 | 61 | 64 |
| range | | 29-894 | 68-1,490 | 0-2,102 | 572-2,627 |
| POTR/PRVI/CAGE | 6 | | | | |
| mean | | 502 | 275 | 317 | 1,094 |
| SE | | 69 | 122 | 99 | 209 |
| range | | 183-631 | 25-722 | 68-722 | 684-2,062 |
| POTR/SARA | 8 | | | | |
| mean | | 417 | 630 | 157 | 1.204 |
| SE | | 111 | 130 | 72 | 170 |
| range | | 72-895 | 138-1,327 | 10-540 | 552-2,159 |
| POTR/SYOR/SESE | 39 | | | | |
| mean | | 307 | 823 | 375 | 1,504 |
| SE | | 54 | 100 | 62 | 114 |
| range | | 26-1,687 | 95-2,513 | 6-1,375 | 434-2,956 |
| POTR/SYOR/CAGE | 14 | | | | |
| mean | | 274 | 534 | 394 | 1,202 |
| SE | | 46 | 95 | 99 | 154 |
| range | | 45-609 | 128-1,452 | 38-1,454 | 372-2,234 |
| POTR/SYOR/FETH | 2 | | | | |
| mean | | 374 | 178 | 110 | 662 |
| SE | | 26 | 169 | 64 | 207 |
| range | | 348-400 | 9-348 | 46-174 | 455-869 |
| POTR/JUCO/CAGE | 9 | | | | |
| mean | | 163 | 221 | 276 | 670 |
| SE | | 66 | 55 | 65 | 113 |
| range | | 8-579 | 20-472 | 49-630 | 158-1,158 |
| POTR/SYOR/BRCA | 2 | | | | |
| mean | | 135 | 331 | 681 | 1,148 |
| SE | | 46 | 202 | 474 | 629 |
| range | | 89-182 | 130-533 | 208-1,155 | 519-1,777 |
| POTR/SYOR/POPR | 3 | | | | |
| mean | | 339 | 360 | 345 | 1,042 |
| SE | | 124 | 79 | 94 | 285 |
| range | | 96-503 | 215-487 | 167-487 | 479-1,391 |
| POTR/VECA | 1 | | | | |
| mean | | 18 | 604 | 1,154 | 1,775 |
| SE | | — | — | — | — |
| range | | — | — | — | — |
| POTR/HELA | 5 | | | | |
| mean | | 220 | 1,044 | 114 | 1,378 |
| SE | | 197 | 100 | 59 | 158 |
| range | | 11-1,006 | 782-1,329 | 12-279 | 1,073-1,899 |
| POTR/PTAQ | 3 | | | | |
| mean | | 38 | 1,598 | 125 | 1,762 |
| SE | | 20 | 487 | 65 | 420 |
| range | | 12-78 | 930-2,546 | 0-221 | 1,162-2,572 |
| POTR/SESE | 59 | | | | |
| mean | | 46 | 923 | 321 | 1,289 |
| SE | | 12 | 68 | 40 | 74 |
| range | | 0-540 | 92-2,401 | 6-1,077 | 263-3,202 |

(con.)

## APPENDIX D1. (Con.)

| Community type | N[1] | Shrubs | Forbs | Graminoids | Total |
|---|---|---|---|---|---|
| | | kg/ha | | | |
| POTR/CAGE | 23 | | | | |
| mean | | 27 | 303 | 415 | 746 |
| SE | | 8 | 58 | 72 | 83 |
| range | | 4-191 | 35-999 | 9-1,108 | 88-1,447 |
| POTR/FETH | 5 | | | | |
| mean | | 13 | 557 | 797 | 1,367 |
| SE | | 7 | 188 | 529 | 647 |
| range | | 0-39 | 99-980 | 72-2,900 | 502-3,919 |
| POTR/SIHY | 5 | | | | |
| mean | | 11 | 271 | 249 | 530 |
| SE | | 5 | 116 | 70 | 105 |
| range | | 4-29 | 8-545 | 29-370 | 358-923 |
| POTR/BRCA | 5 | | | | |
| mean | | 60 | 626 | 683 | 1,369 |
| SE | | 45 | 175 | 220 | 285 |
| range | | 0-238 | 117-1,089 | 63-1,348 | 417-2,106 |
| POTR/POPR | 8 | | | | |
| mean | | 46 | 512 | 318 | 876 |
| SE | | 18 | 148 | 58 | 135 |
| range | | 0-131 | 35-1,063 | 20-478 | 340-1,445 |
| POTR-ABLA/AMAL | 6 | | | | |
| mean | | 752 | 503 | 155 | 1,410 |
| SE | | 320 | 119 | 59 | 252 |
| range | | 142-1,843 | 184-924 | 13-355 | 649-2,229 |
| POTR-ABLA/SYOR/SESE | 13 | | | | |
| mean | | 262 | 665 | 200 | 1,127 |
| SE | | 55 | 106 | 79 | 157 |
| range | | 24-646 | 74-1,572 | 2-833 | 227-2,380 |
| POTR-ABLA/SYOR/CAGE | 3 | | | | |
| mean | | 230 | 507 | 135 | 872 |
| SE | | 123 | 278 | 8 | 209 |
| range | | 36-457 | 142-1,053 | 121-147 | 491-1,210 |
| POTR-ABLA/JUCO | 12 | | | | |
| mean | | 142 | 151 | 127 | 420 |
| SE | | 83 | 41 | 51 | 100 |
| range | | 8-1,022 | 4-462 | 2-550 | 88-1,278 |
| POTR-ABLA/SESE | 46 | | | | |
| mean | | 25 | 597 | 241 | 861 |
| SE | | 5 | 68 | 49 | 82 |
| range | | 0-172 | 40-2,440 | 2-1,660 | 78-2,568 |
| POTR-ABLA/CAGE | 31 | | | | |
| mean | | 6 | 188 | 110 | 304 |
| SE | | 2 | 36 | 28 | 50 |
| range | | 0-25 | 1-791 | 1-675 | 3-1,026 |
| POTR-ABCO/SYOR | 7 | | | | |
| mean | | 185 | 217 | 71 | 473 |
| SE | | 38 | 78 | 49 | 121 |
| range | | 77-309 | 17-581 | 2-349 | 211-1,162 |
| POTR-PSME/AMAL | 4 | | | | |
| mean | | 322 | 344 | 173 | 839 |
| SE | | 126 | 57 | 100 | 109 |
| range | | 18-613 | 214-446 | 6-452 | 630-1,115 |
| POTR-PIPO/QUGA | 1 | | | | |
| mean | | 238 | 278 | 278 | 794 |
| SE | | — | — | — | — |
| range | | — | — | — | — |

(con.)

## APPENDIX D1. (Con.)

| Community type | N[1] | Shrubs | Forbs | Graminoids | Total |
|---|---|---|---|---|---|
| | | kg/ha | | | |
| POTR-PIPO/JUCO | 1 | | | | |
| mean | | 96 | 72 | 312 | 480 |
| SE | | — | — | — | — |
| range | | — | — | — | — |
| POTR-PICO/JUCO | 5 | | | | |
| mean | | 52 | 478 | 146 | 677 |
| SE | | 31 | 123 | 41 | 98 |
| range | | 7-176 | 16-740 | 35-287 | 326-925 |

[1]Number of intensively sampled stands.

## APPENDIX D2: MEANS, STANDARD ERRORS (SE), AND RANGES OF ANNUAL UNDERGROWTH PRODUCTION BY VEGETATION CLASSES EXPRESSED IN DRY WEIGHT POUNDS PER ACRE

| Community type | N[1] | Shrubs | Forbs | Graminoids | Total |
|---|---|---|---|---|---|
| | | Lb/acre | | | |
| POTR/ACGR/PTAQ | 5 | | | | |
| mean | | 130 | 1,793 | 144 | 2,068 |
| SE | | 100 | 498 | 93 | 514 |
| range | | 16-529 | 786-3,565 | 8-492 | 836-3,792 |
| POTR/PRVI/SESE | 41 | | | | |
| mean | | 344 | 543 | 254 | 1,141 |
| SE | | 33 | 50 | 55 | 57 |
| range | | 25-797 | 61-1,328 | 0-1,873 | 509-2,341 |
| POTR/PRVI/CAGE | 6 | | | | |
| mean | | 447 | 245 | 282 | 975 |
| SE | | 62 | 109 | 88 | 186 |
| range | | 163-563 | 22-643 | 61-643 | 609-1,838 |
| POTR/SARA | 8 | | | | |
| mean | | 372 | 561 | 140 | 1,072 |
| SE | | 99 | 116 | 64 | 152 |
| range | | 64-797 | 123-1,182 | 9-481 | 491-1,924 |
| POTR/SYOR/SESE | 39 | | | | |
| mean | | 273 | 733 | 334 | 1,340 |
| SE | | 48 | 89 | 55 | 102 |
| range | | 23-1,503 | 85-2,239 | 6-1,226 | 386-2,634 |
| POTR/SYOR/CAGE | 14 | | | | |
| mean | | 244 | 476 | 351 | 1,071 |
| SE | | 41 | 85 | 88 | 137 |
| range | | 40-542 | 114-1,294 | 33-1,295 | 331-1,990 |
| POTR/SYOR/FETH | 2 | | | | |
| mean | | 333 | 159 | 98 | 590 |
| SE | | 24 | 151 | 57 | 184 |
| range | | 310-357 | 8-310 | 41-155 | 405-774 |
| POTR/JUCO/CAGE | 9 | | | | |
| mean | | 146 | 197 | 246 | 597 |
| SE | | 59 | 49 | 58 | 101 |
| range | | 7-516 | 18-421 | 44-561 | 141-1,031 |
| POTR/SYOR/BRCA | 2 | | | | |
| mean | | 121 | 295 | 607 | 1,023 |
| SE | | 41 | 180 | 422 | 560 |
| range | | 79-162 | 116-475 | 185-1,029 | 463-1,583 |

(con.)

## APPENDIX D2. (Con.)

| Community type | N[1] | Shrubs | Forbs | Graminoids | Total |
|---|---|---|---|---|---|
| | | Lb/acre | | | |
| POTR/SYOR/POPR | 3 | | | | |
| mean | | 302 | 321 | 306 | 929 |
| SE | | 110 | 70 | 84 | 254 |
| range | | 85-448 | 192-434 | 149-434 | 426-1,240 |
| POTR/VECA | 1 | | | | |
| mean | | 16 | 538 | 1,028 | 1,582 |
| SE | | — | — | — | — |
| range | | — | — | — | — |
| POTR/HELA | 5 | | | | |
| mean | | 196 | 930 | 101 | 1,228 |
| SE | | 175 | 89 | 53 | 141 |
| range | | 10-897 | 697-1,184 | 11-249 | 956-1,692 |
| POTR/PTAQ | 3 | | | | |
| mean | | 34 | 1,424 | 112 | 1,570 |
| SE | | 18 | 434 | 58 | 375 |
| range | | 10-69 | 828-2,269 | 0-197 | 1,035-2,292 |
| POTR/SESE | 59 | | | | |
| mean | | 41 | 822 | 286 | 1,149 |
| SE | | 11 | 60 | 36 | 66 |
| range | | 0-481 | 82-2,140 | 6-960 | 234-2,853 |
| POTR/CAGE | 23 | | | | |
| mean | | 24 | 270 | 370 | 665 |
| SE | | 7 | 52 | 64 | 74 |
| range | | 4-170 | 31-890 | 8-987 | 78-1,289 |
| POTR/FETH | 5 | | | | |
| mean | | 11 | 497 | 710 | 1,218 |
| SE | | 6 | 168 | 472 | 576 |
| range | | 0-35 | 88-873 | 65-2,584 | 448-3,492 |
| POTR/SIHY | 5 | | | | |
| mean | | 10 | 241 | 222 | 472 |
| SE | | 4 | 104 | 63 | 94 |
| range | | 3-26 | 7-485 | 26-330 | 319-823 |
| POTR/BRCA | 5 | | | | |
| mean | | 53 | 558 | 608 | 1,219 |
| SE | | 40 | 156 | 196 | 254 |
| range | | 0-212 | 104-970 | 56-1,201 | 371-1,877 |
| POTR/POPR | 8 | | | | |
| mean | | 41 | 456 | 283 | 780 |
| SE | | 16 | 132 | 52 | 120 |
| range | | 0-117 | 31-947 | 17-426 | 303-1,287 |
| POTR-ABLA/AMAL | 6 | | | | |
| mean | | 670 | 449 | 138 | 1,256 |
| SE | | 285 | 106 | 53 | 225 |
| range | | 127-1,642 | 164-823 | 12-317 | 578-1,986 |
| POTR-ABLA/SYOR/SESE | 13 | | | | |
| mean | | 235 | 594 | 174 | 1,004 |
| SE | | 49 | 94 | 70 | 140 |
| range | | 22-575 | 66-1,400 | 2-742 | 202-2,121 |
| POTR-ABLA/SYOR/CAGE | 3 | | | | |
| mean | | 205 | 452 | 120 | 777 |
| SE | | 109 | 247 | 7 | 186 |
| range | | 32-408 | 131-938 | 108-131 | 437-1,079 |
| POTR-ABLA/JUCO | 12 | | | | |
| mean | | 127 | 134 | 113 | 374 |
| SE | | 74 | 40 | 46 | 89 |
| range | | 7-911 | 4-411 | 2-490 | 78-1,139 |

(con.)

## APPENDIX D2. (Con.)

| Community type | N[1] | Shrubs | Forbs | Graminoids | Total |
|---|---|---|---|---|---|
| | | Lb/acre | | | |
| POTR-ABLA/SESE | 46 | | | | |
| mean | | 22 | 532 | 214 | 767 |
| SE | | 5 | 61 | 44 | 73 |
| range | | 0-153 | 36-2,174 | 1-1,479 | 69-2,289 |
| POTR-ABLA/CAGE | 31 | | | | |
| mean | | 5 | 168 | 98 | 271 |
| SE | | 1 | 32 | 25 | 46 |
| range | | 0-22 | 1-705 | 1-601 | 3-915 |
| POTR-ABCO/SYOR | 7 | | | | |
| mean | | 165 | 193 | 64 | 422 |
| SE | | 26 | 70 | 44 | 108 |
| range | | 69-275 | 15-518 | 2-311 | 188-1,036 |
| POTR-PSME/AMAL | 4 | | | | |
| mean | | 287 | 307 | 154 | 748 |
| SE | | 112 | 51 | 89 | 97 |
| range | | 16-547 | 191-398 | 6-402 | 561-994 |
| POTR-PIPO/QUGA | 1 | | | | |
| mean | | 212 | 248 | 248 | 707 |
| SE | | — | — | — | — |
| range | | — | — | — | — |
| POTR-PIPO/JUCO | 1 | | | | |
| mean | | 86 | 64 | 278 | 428 |
| SE | | — | — | — | — |
| range | | — | — | — | — |
| POTR-PICO/JUCO | 5 | | | | |
| mean | | 47 | 426 | 130 | 603 |
| SE | | 28 | 109 | 37 | 87 |
| range | | 6-157 | 15-659 | 31-255 | 290-824 |

[1]Number of intensively sampled stands.

# APPENDIX E: PROPORTION OF YEARLY UNDERGROWTH PRODUCTION IN DIFFERENT VEGETATION CATEGORIES BY ASPEN COMMUNITY TYPES, AND THE SUITABILITY OF THIS UNDERGROWTH AS LIVESTOCK FORAGE

| Community type | Vegetation categories | | | Forage suitability[1] | | |
|---|---|---|---|---|---|---|
| | Shrubs | Forbs | Graminoids | Desirable | Intermediate | Least |
| | Percent | | | | | |
| POTR/ACGR/PTAQ | 6 | 87 | 7 | 35 | 29 | 36 |
| POTR/PRVI/SESE | 30 | 48 | 22 | 55 | 40 | 5 |
| POTR/PRVI/CAGE | 46 | 25 | 29 | 55 | 41 | 4 |
| POTR/SARA | 35 | 52 | 13 | 52 | 37 | 11 |
| POTR/SYOR/SESE | 20 | 55 | 25 | 51 | 37 | 12 |
| POTR/SYOR/CAGE | 23 | 44 | 33 | 51 | 40 | 9 |
| POTR/SYOR/FETH | 56 | 27 | 17 | 52 | 45 | 3 |
| POTR/JUCO/CAGE | 24 | 34 | 42 | 53 | 38 | 9 |
| POTR/JUCO/SIHY | — | — | — | 46 | 47 | 7 |
| POTR/SYOR/BRCA | 12 | 29 | 59 | 46 | 51 | 3 |
| POTR/SYOR/POPR | 33 | 34 | 33 | 30 | 65 | 5 |
| POTR/JUCO/ASMI | — | — | — | 27 | 53 | 20 |
| POTR/VECA | 1 | 34 | 65 | 33 | 26 | 41 |
| POTR/HELA | 16 | 76 | 8 | 57 | 28 | 15 |
| POTR/PTAQ | 2 | 91 | 7 | 26 | 27 | 48 |
| POTR/SESE | 3 | 72 | 25 | 48 | 31 | 21 |
| POTR/CAGE | 4 | 41 | 55 | 57 | 36 | 7 |
| POTR/FETH | 1 | 41 | 58 | 47 | 42 | 11 |
| POTR/SIHY | 2 | 51 | 47 | 62 | 33 | 5 |
| POTR/BRCA | 4 | 46 | 50 | 35 | 60 | 5 |
| POTR/POPR | 5 | 58 | 37 | 29 | 69 | 2 |
| POTR-ABLA/VACA | — | — | — | 37 | 63 | 0 |
| POTR-ABLA/AMAL | 53 | 36 | 11 | 62 | 35 | 3 |
| POTR-ABLA/SYOR/SESE | 23 | 59 | 18 | 54 | 35 | 11 |
| POTR-ABLA/SYOR/CAGE | 26 | 58 | 16 | 55 | 36 | 9 |
| POTR-ABLA/JUCO | 34 | 36 | 30 | 45 | 48 | 7 |
| POTR-ABLA/SESE | 3 | 69 | 28 | 55 | 34 | 11 |
| POTR-ABLA/CAGE | 2 | 62 | 36 | 51 | 45 | 4 |
| POTR-ABCO/SYOR | 39 | 46 | 15 | 51 | 44 | 5 |
| POTR-ABCO/JUCO | — | — | — | 41 | 55 | 4 |
| POTR-PSME/AMAL | 38 | 41 | 21 | 45 | 47 | 8 |
| POTR-PSME/JUCO | — | — | — | 41 | 48 | 11 |
| POTR-PIPO/QUGA | 30 | 35 | 35 | 50 | 42 | 8 |
| POTR-PIPO/JUCO | 20 | 15 | 65 | 55 | 43 | 2 |
| POTR-PICO/VASC | — | — | — | 58 | 39 | 3 |
| POTR-PICO/JUCO | 8 | 71 | 21 | 44 | 51 | 5 |

[1]Based on proportionate canopy cover in suitability classes described by USDA Forest Service (1981).

# APPENDIX F: PROPORTION OF ASPEN STANDS SAMPLED IN EACH OF UTAH'S NATIONAL FORESTS THAT WERE CLASSIFIED IN DIFFERENT ASPEN COMMUNITY TYPES

| Community types | National Forests | | | | | | |
|---|---|---|---|---|---|---|---|
| | Wasatch-Cache | Ashley | Uinta | Manti-LaSal | Fishlake | Dixie | All forests |
| (No. of stands classified) | (399) | (115) | (240) | (144) | (125) | (156) | (1,179) |
| | *Percent* | | | | | | |
| POTR/ACGR/PTAQ | 2 | 1 | 1 | 0 | 0 | 1 | 1 |
| POTR/PRVI/SESE | 19 | 0 | 13 | 4 | 1 | 0 | 10 |
| POTR/PRVI/CAGE | 1 | 2 | 1 | 1 | 0 | 1 | 1 |
| POTR/SARA | 1 | 0 | 2 | 5 | 1 | 0 | 1 |
| POTR/SYOR/SESE | 14 | 0 | 27 | 15 | 6 | 0 | 13 |
| POTR/SYOR/CAGE | 1 | 10 | 5 | 10 | 8 | 6 | 5 |
| POTR/SYOR/FETH | 0 | 0 | 0 | 0 | 2 | 3 | 1 |
| POTR/JUCO/CAGE | 5 | 31 | 1 | 0 | 9 | 1 | 6 |
| POTR/JUCO/SIHY | T[1] | 5 | T | 1 | 6 | 2 | 2 |
| POTR/SYOR/BRCA | 2 | 2 | 0 | 1 | 0 | 0 | 1 |
| POTR/SYOR/POPR | 2 | 3 | 1 | 4 | 0 | 5 | 3 |
| POTR/JUCO/ASMI | 2 | 1 | 0 | 0 | 0 | 0 | 1 |
| POTR/VECA | T | 0 | T | 0 | 0 | 0 | T |
| POTR/HELA | 2 | 0 | 2 | 1 | 1 | 0 | 1 |
| POTR/PTAQ | 2 | 0 | 3 | 0 | 0 | 1 | 1 |
| POTR/SESE | 13 | 1 | 18 | 12 | 4 | 3 | 11 |
| POTR/CAGE | 3 | 4 | 3 | 5 | 8 | 5 | 4 |
| POTR/FETH | 0 | 0 | 0 | 0 | 5 | 5 | 1 |
| POTR/SIHY | 0 | 1 | 0 | 0 | 1 | 6 | 1 |
| POTR/BRCA | 1 | 0 | 1 | 4 | 2 | 0 | 1 |
| POTR/POPR | T | 3 | T | 3 | 2 | 3 | 1 |
| POTR-ABLA/VACA | 1 | 1 | 0 | 0 | 0 | 0 | T |
| POTR-ABLA/AMAL | 2 | 0 | T | 1 | 0 | 0 | 1 |
| POTR-ABLA/SYOR/SESE | 6 | 3 | 6 | 3 | 2 | 1 | 4 |
| POTR-ABLA/SYOR/CAGE | T | 2 | T | 3 | 2 | 1 | 1 |
| POTR-ABLA/JUCO | 1 | 4 | 0 | 0 | 10 | 9 | 3 |
| POTR-ABLA/SESE | 10 | 2 | 8 | 12 | 8 | 3 | 8 |
| POTR-ABLA/CAGE | 2 | 3 | T | 3 | 13 | 28 | 7 |
| POTR-ABCO/SYOR | T | 0 | 4 | 7 | 4 | 1 | 2 |
| POTR-ABCO/JUCO | 0 | 2 | 0 | 1 | 6 | 5 | 2 |
| POTR-PSME/AMAL | 2 | 0 | 1 | 1 | 0 | 0 | 1 |
| POTR-PSME/JUCO | 0 | 4 | 0 | 0 | 0 | 2 | 1 |
| POTR-PIPO/QUGA | 0 | 1 | 0 | 3 | 0 | 1 | T |
| POTR-PIPO/JUCO | 0 | 2 | 0 | 0 | 0 | 7 | 1 |
| POTR-PICO/VASC | 1 | 2 | 0 | 0 | 0 | 0 | 1 |
| POTR-PICO/JUCO | 4 | 10 | T | 0 | 0 | 0 | 2 |

[1]T = less than 0.5 percent.

# APPENDIX G: UTAH ASPEN COMMUNITY TYPE FIELD FORM

**STUDY:** **DATE:** **EXAMINER:**

CANOPY COVER ESTIMATES:
Estimate cover of each species as:
- trace (T) if less than 0.5%
- to nearest 1% if less than 10%
- to nearest 5% if over 10%

Estimate cover of trees (over 1.4 m high) and reproduction (less than 1.4 m high) separately (e.g. 40/5).

TOPOGRAPHY
1-Ridge 4-Lower slope
2-Upper slope 5-Bench/flat
3-Mid slope 6-Stream bot.

CONFIGURATION
1-Convex 3-Concave
2-Straight 4-Undulate

| | | | |
|---|---|---|---|
| Plot No. | | | |
| Meridian | | | |
| T,R,S | | | |
| Elevation | | | |
| Aspect | | | |
| % slope | | | |
| Topography | | | |
| Configuration | | | |
| Other: | | | |

| TREES Scientific Name | Abbreviation | Common Name | Canopy Cover % | | |
|---|---|---|---|---|---|
| Abies concolor | ABCO | white fir | --- / --- | --- / --- | --- / --- |
| Abies lasiocarpa | ABLA | subalpine fir | | | |
| Picea engelmannii | PIEN | Engelmann spruce | --- / --- | --- / --- | --- / --- |
| Picea pungens | PIPU | blue spruce | --- / --- | --- / --- | --- / --- |
| Pinus contorta | PICO | lodgepole pine | | | |
| Pinus ponderosa | PIPO | ponderosa pine | --- / --- | --- / --- | --- / --- |
| Populus tremuloides | POTR | quaking aspen | --- / --- | --- / --- | --- / --- |
| Pseudotsuga menziesii | PSME | Douglas-fir | | | |
| **SHRUBS** | | | | | |
| Acer grandidentatum | ACGR | canyon maple | | | |
| Amelanchier alnifolia | AMAL | western serviceberry | | | |
| Artemisia tridentata | ARTR | big sagebrush | | | |
| Juniperus communis | JUCO | common juniper | | | |
| Prunus virginiana | PRVI | chokecherry | | | |
| Quercus gambelii | QUGA | Gambel oak | | | |
| Rubus parviflorus | RUPA | thimbleberry | | | |
| Sambucus cerulea | SACE | blue elder | | | |
| Sambucus racemosa | SARA | European elderberry | | | |
| Symphoricarpos oreophilus | SYOR | mountain snowberry | | | |
| Vaccinium caespitosum | VACA | dwarf blueberry | | | |
| Vaccinium scoparium | VASC | grouse whortleberry | | | |
| **GRAMINOIDS** | | | | | |
| Bromus carinatus | BRCA | mountain brome | | | |
| Calamagrostis rubescens | CARU | pinegrass | | | |
| Carex geyeri | CAGE | elk sedge | | | |
| Carex obtusata | CAOB | obtuse sedge | | | |
| Carex rossii | CARO | Ross sedge | | | |
| Elymus glaucus | ELGL | blue wildrye | | | |
| Festuca idahoensis | FEID | Idaho fescue | | | |
| Festuca thurberi | FETH | Thurber fescue | | | |
| Poa pratensis | POPR | Kentucky bluegrass | | | |
| Sitanion hystrix | SIHY | bottlebrush squirreltail | | | |
| Stipa comata | STCO | needle-and-thread | | | |
| Stipa lettermanii | STLE | Letterman needlegrass | | | |
| Stipa occidentalis | STOC | western needlegrass | | | |
| **FORBS** | | | | | |
| Agastache urticifolia | AGUR | nettleleaf giant hyssop | | | |
| Aster engelmannii | ASEN | Engelmann aster | | | |
| Astragalus miser | ASMI | weedy milkvetch | | | |
| Delphinium occidentale | DEOC | duncecap larkspur | | | |
| Heracleum lanatum | HELA | common cowparsnip | | | |
| Mertensia arizonica | MEAR | tall bluebell | | | |
| Osmorhiza occidentalis | OSOC | sweetanise | | | |
| Polemonium foliosissimum | POFO | leafy polemonium | | | |
| Pteridium aquilinum | PTAQ | brakenfern | | | |
| Rudbeckia occidentalis | RUOC | western coneflower | | | |
| Scrophularia lanceolata | SCLA | lanceleaf figwort | | | |
| Senecio serra | SESE | butterweed groundwel | | | |
| Taraxacum officinale | TAOF | common dandelion | | | |
| Valeriana occidentalis | VAOC | western valerian | | | |
| Veratrum californicum | VECA | California false-hellebore | | | |

| | | | |
|---|---|---|---|
| COVER TYPE | | | |
| COMMUNITY TYPE | | | |

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Mueggler, Walter F.; Campbell, Robert B., Jr. Aspen community types of Utah. Research Paper INT-362. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1986. 69 p.

A vegetation classification for the aspen-dominated forests of Utah is based upon existing community structure and plant species composition. Included are 36 community types that occur within six cover-type categories. A diagnostic key using indicator species facilitates field identification of the community types. Vegetational composition, productivity, and successional status are included. Tables provide detailed comparisons of community types. The classification and descriptions are based upon data from over 1,200 aspen stands scattered across the six National Forests within Utah.

KEYWORDS: aspen forests, community types, vegetation classification, Utah, forest ecology

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